The International Journal of Orthodontia

Editor: Martin Dewey, D.D.S., M.D.

VOL. IV ST. LOUIS, JUNE, 1918 NO. 6

ORIGINAL ARTICLES

MULTIPLE FRACTURE OF THE MANDIBLE, CAUSING A MARKED DENTOFACIAL DEFORMITY, THE RESULT OF A DYNAMITE EXPLOSION—METHOD OF TREATMENT: SURGICAL, ORTHODONTIC, AND PROSTHETIC

BY M. N. FEDERSPIEL, B.Sc., D.D.S., M.D.

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MY REASON for reporting this interesting case is to show what can be accomplished in the treating of a multiple fracture with loss of tissue, leaving a marked displacement of the mandible. On March 8 I was called to Mt. Sinai Hospital to treat a fractured mandible of Mr. K., age twenty-seven years.

HISTORY

A premature explosion while blasting rocks shattered the patient's arm and produced a multiple fracture of the mandible. I found a fracture of the neck of the condyle on the left side with the condyle torn out of its glenoid fossa and lying in front of the eminentia articularis, a compound fracture between the left cuspid and lateral and another fracture between the right second bicuspid and first molar.

On account of the patient being in a precarious condition, it was deemed advisable not to attempt fitting any fixed appliance to his teeth in order to immobilize the broken jaw, until he was strong enough to sit up. However, a temporary splint was fitted.

In the meantime, Dr. Charles Lemon amputated his arm. After five days had passed and the patient was stronger and recovering from the shock of the explosion and the operation on his arm, I proceeded to prepare him for treatment of the injured mandible.

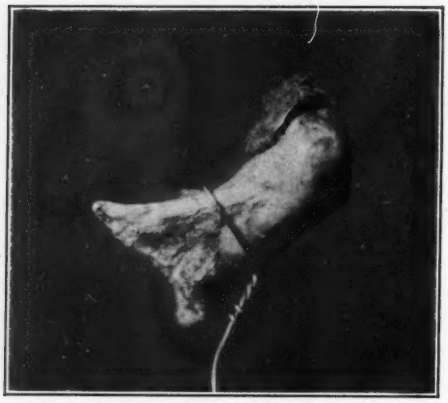


Fig. 1.

Fig. 2.

Fig. 5.

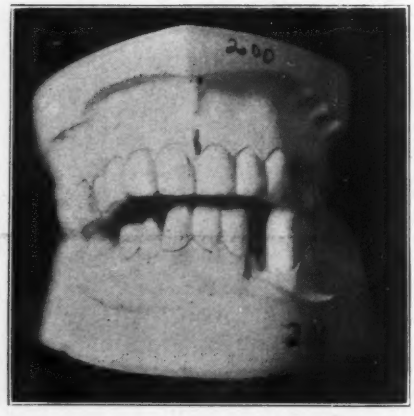


Fig. 3.

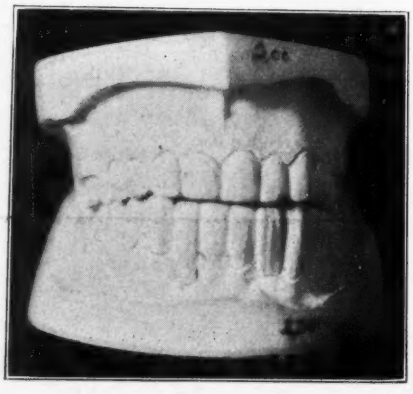


Fig. 4.

At this time, an infection had developed at the fractured points with pus flowing freely. The left lower lateral and left central were knocked out at the time of the explosion and from the sockets of the lost teeth pus was oozing. A subperiosteal abscess had developed below the chin. Upon passing a probe through either one of the sockets it would pass through the bone into the subperiosteal abscess.

The compound fracture on the right side of the mandible, which was between the second bicuspid and the remaining diseased root of the first molar, was also suppurating into the mouth, and the gland below it was very much enlarged. On account of the neck of the left condyle being fractured and the condyle torn from the socket, rotated and lying in front of the eminentia articularis, the jaw shifted backwards causing the facial lines to be very much distorted. In consultation with Lemon it was deemed advisable to remove the condyle surgically after immobilizing the two compound fractures of the mandible and later correct the occlusion by orthodontic treatments.

Bands of nickel silver were fitted to the first and second molars on each side. A tube, gauge 16, was soldered to the bands and cemented in place. Plain bands with small hooks attached were cemented on the teeth anterior to the molars. The next day, under local anesthesia, I curetted the diseased bone at the fractured points, opened up the subperiosteal abscess, packed the wound with iodoform gauze, and extracted the diseased roots of the lower right first molar. An alignment wire, gauge 16, was then slipped into the tubing attached to the molar bands, the wire being shaped so it rested neatly on the labial surfaces of the teeth. The fractured parts were then brought together and the teeth firmly ligated to the alignment wire with bronze wire, gauge 28.

This simple appliance firmly immobilized the broken bone, the jaw was then bandaged and treated daily by cleansing the teeth and changing the gauze. After four weeks the patient was ready to have the condyle removed. This was done under ether anesthesia by Dr. Charles Lemon (Fig. 1). The condyle was found lying in front of the eminentia articularis and rotated. It was freed from the soft tissues and the wound closed. The wound healed without any complication. Four weeks later he left the hospital. By this time the mandible had united at the fractured points. Due to the loss of the lower left central and lateral and the necrosed bone in that region and the loss of the left condyle, the mandible was contracted and shifted to one side. This condition produced a marked distortion of the facial lines (Fig. 2).

On April 22 he was put under orthodontic treatment. The right second molar and second and first bicuspids and cuspid were slowly moved buccally, the right lateral brought forward and distally so that a space was obtained between the right central and lateral of sufficient size to permit an artificial tooth to be bridged in. Under this form of treatment the facial lines were brought to a more normal position (Figs. 3 and 4).

The patient was now ready for bridge work and this was done by my associate, Dr. A. C. Rohde.

Under the above form of treatment the facial lines were corrected and the occlusal lines improved (Fig. 5).

THE DEVELOPMENT OF OCCLUSION*

By Alfred P. Rogers, D.D.S., Boston, Mass.

YOUR committee has provided for your winter's study a series of lectures designed to illustrate, first, the human mouth and its surrounding tissues in a state of health; second, its various phases of abnormal development or disease; third, its restoration or development to the normal.

In order to present these subjects in the best way, the lectures have been arranged in a sequence, which, I trust, when fully presented will yield a wealth of instruction, resulting not only in a valuable addition to our knowledge, but proving also a stimulation to greater effort and more numerous successes. Two of these papers have already been read to you by men well qualified by study and experience. Whatever in their papers may have a bearing upon the subject matter of our present study you will readily recognize and no doubt apply.

You will understand, I am sure, that in treating the subject, "The Development of Occlusion," it will be impossible for me to begin at the beginning and carry you through all that the subject might call for in its complete treatment.

My efforts for you must consist of a more or less incomplete account of my own experiences in the important matter of corrective treatment, and its retention, *particularly during the important period of abnormal variations of development.* From the nature of our study, interest can not be confined to the teeth alone, but must broaden until it embraces those surrounding parts which will be recognized as of vital importance, not only to the successful establishment of occlusion, but also to its successful maintenance.

Before I take up with you any consideration of the practical aspect of orthodontia it will be necessary for us to endeavor to obtain a clear conception of the present scope of the science.

No one of you who has interested himself in orthodontia many years can fail to be impressed with its growth in its different directions. It would be indeed interesting to review these various stages of progress, but its details are, I assume, quite familiar to most of you, and I shall, therefore, pass over them with slight reference. However, in order that we may all start with a common viewpoint, I shall endeavor to define the various subdivisions of our science and lightly trace their connections.

It is true of orthodontia, as it is true of medicine, that the history of its early practice shows that it was conducted in an entirely empirical manner. Gradually the methods of empiricism were tested and sifted through the meshes of scientific thought until there was established the basis of the science of orthodontia. We understand the importance of these early stages when we become mindful of the fact that empiricism is the origin of much of our knowledge. It is simply that we learn from experience, for this great teacher constituted the foundation of practice for our predecessors. Their operative procedures were established solely upon their accumulated experience. In those early days,

*Read before the First District Dental Society, S. N. Y., Dec. 3, 1917. Reprinted by special permission from the Journal of the Allied Dental Societies, March, 1918.

methods of art as applied to orthodontia were crude and quite inefficient. The systematic application of knowledge and skill in effecting wished for results left much to be desired before it could be defined as science, or recognized as art, but, as the methods of empiricism became more thoroughly understood, science began to appear in our theories and practices. Knowledge became systematized. Particularly is this true in reference to their discovery of the underlying truths, such as the "laws of occlusion," and the resulting first classification. Later in its development came the employment of systematic knowledge as applied to physical, mechanical and mental sciences.

You can readily understand then how each of these attributes—empirical practice, art and the collateral sciences, became merged in such a way as to form the real foundation for what is now regarded as a true and useful science. Some still fail to recognize this interdependence, and are apt, even yet, to lay undue stress on the importance of one subject over the other. For instance, the scientific mind, embracing as it does the cold and inflexible methods of science, is sometimes unmindful of the aid furnished it through the agency of art or the methods of empiricism. The craftsman fails, at times, in his recognition of these important scientific principles which are recognized as essential. Some minds fail to recognize either science or art. Their efforts are recognized by the grossest misjudgments and the crudest attempts. Others do not yet recognize that psychology has an important part to play in the management of children during the correction of malocclusion, and many also fail to recognize the value of scientific exercises of the various muscle groups. It is not good judgment, then, for anyone to proceed upon the practice of orthodontia unless he is willing to give the proper amount of attention to the consideration of all of these.

By no amunt of study can the man who is destitute of the instinct of the artist acquire that delicate manual skill that is necessary for accomplishment. Neither is it possible for the one destitute of knowledge of practical psychology to deal successfully with the many harassing problems of harmful habits in the child. The man who is destitute of the teachings of the purely scientific aspects of our work, is as truly at a loss as the untutored in any other field. If anyone chooses to ignore these basic principles in the practice of orthodontia, he is, at once, at a loss upon what to base his judgments, if indeed he proceeds at all upon a successful course in the treatment of any given case.

STANDARDS AND PRINCIPLES

In order to attain progress in almost any undertaking, speaking in a practical sense, it is of the utmost importance that sufficient attention be given to seeking and finding standards and principles. These important elements are established and formulated largely as a result of study and experience. In seeking and finding them one lays the foundation for future usefulness and success.

We are fortunate in having found a standard that is stable. Its fundamental qualities are the same in all races of men. It is true that in many instances our standard is hard to attain, but even so it is to be the constant goal for all our endeavors. Often the attainment of our standard of occlusion is made difficult because the surrounding tissues of the mouth and face have either some acquired

or inherent abnormality in form or action. Sometimes there is an over intensity and sometimes an undue laxness in some particular group or groups of the facial muscles. The muscular balance is often so interfered with that it becomes a serious problem and one that we have not yet fully understood or mastered. Our lack of knowledge in this particular accounts for a large percentage of our failures. The standard (Fig. 1) that nature has placed before us, is faultless in its harmonious development.

What conclusion must we form from such a guide as this? Is there anyone who is willing to undertake the correction of malocclusion, without first recognizing this standard, and without preparing himself in every possible way to secure ability in his work? What does this beautiful picture reveal? Is it wise or profitable in any given case of malocclusion for us to direct our at-

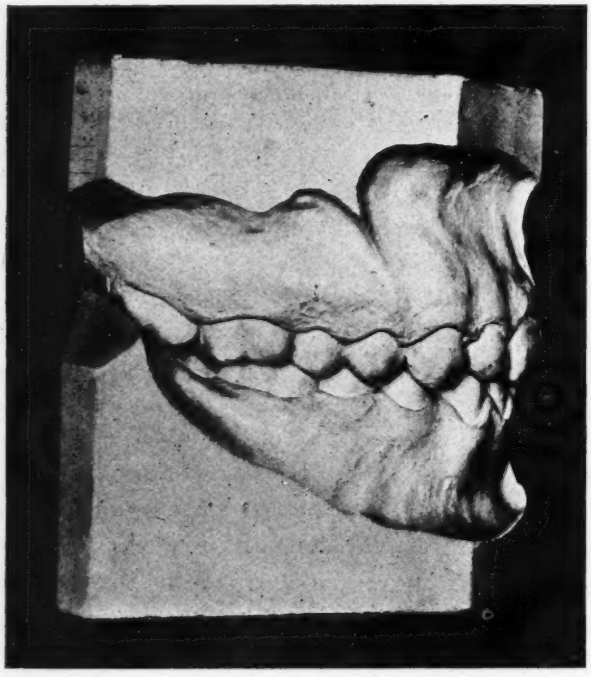


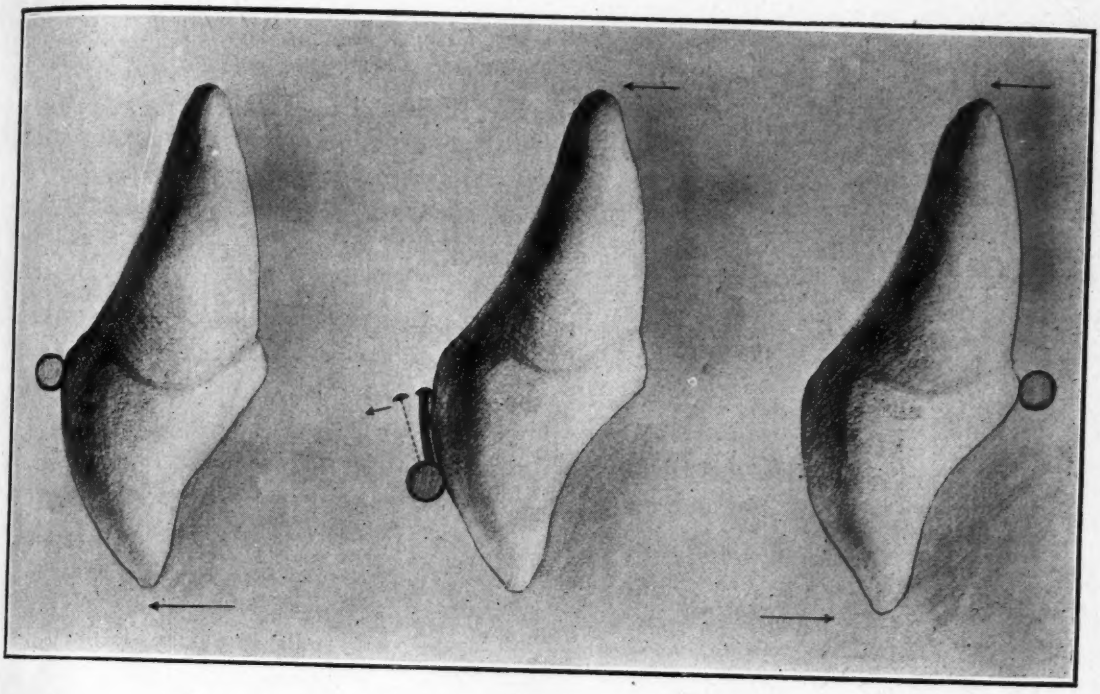
Fig. 1.

tention solely to the teeth? Is there not a standard of development represented here other than that of the teeth? Are they to be framed with indifference? Shall we not seek also a standard of bone development and muscle development? Are these not essential to the full development and maintenance of occlusion?

PLAN OF TREATMENT

I know that you believe with me that the plans that we are laying must be traced in such a way that *the teeth, the surrounding bony tissue, the muscular tissue and function* be rendered *normal* in the *best, easiest and quickest way* that our knowledge can devise.

It is, therefore, our duty to study not alone occlusion, but the health and normality of all these surrounding tissues. One of our first duties must be to



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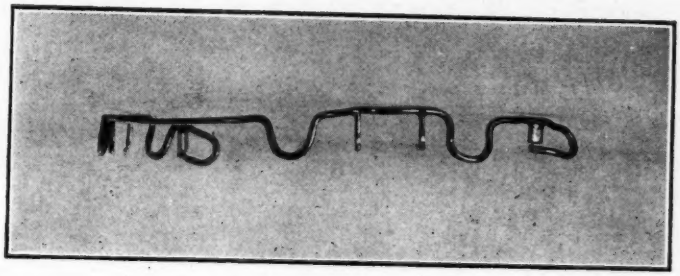

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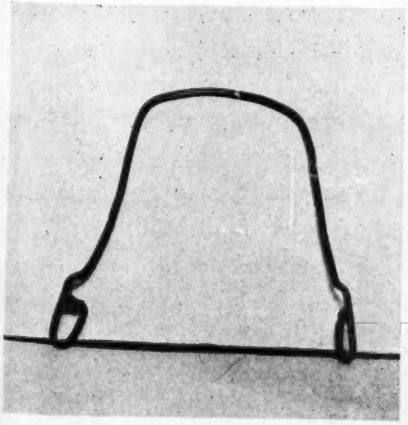

Fig. 4.

Fig. 5.

develop the tissue which is to receive the permanent teeth upon their eruption, commencing at a comparatively early age. *Whatever mechanical stimulation we choose to employ, we must follow it with the development of the function of mastication through muscular development. We must encourage also the development of the respiratory function through adequate and proper exercises. In each case applying methods most suitable to the character of the maldevelopment.*

PRINCIPLES OF CONSTRUCTION OF APPLIANCES

Before we take up the consideration of the treatment of the various cases that I have for your study, let us review some of the important principles involved in the construction of appliances. An orthodontist in his construction of, and in the application of appliances should be most exact in all that he does. His motives should be clearly defined. *He should not forget that he is responsible for the health of the tissues immediately surrounding the teeth, as well as the health of the teeth themselves.* Hastily gotten up appliances, ready-to-wear appliances which are oftentimes inadequate even when carefully adjusted, are to be avoided whenever possible. *The construction and application should be made so carefully that the patient is given the minimum of discomfort not only during the application, but during the long period of their use.* The operator must feel sure that in making this application he not only is causing no harm to the tissue, but is actually, in many cases, affording means of protection of tooth surface through those inevitably careless years of childhood.

The principles that underlie normal development and normal changes of the tooth position must not be ignored or omitted from the plans of construction, or he will in some instances interfere very seriously with the normal processes of development. This principle applies more particularly to the application of appliances to mixed dentures, and must in no instance be forgotten when efforts are being made during this period of transition.

The most valuable appliances are those which interfere least with the normal tendencies of development, and in their construction and adaptation are freest from interference with muscular activities and habit forming possibilities. When it is found necessary to interfere with any normal function, whether it be of the tongue, lips, or cheeks, some form of compensation must be provided. Possibly an illustration here will help us to grasp my meaning to better purpose. The drawing represented in Fig. 2 indicates the direction of the movement for each of the three appliances: Labial wire, pin and tube and lingual wire. It will be seen that with the use of the lingual wire there is greater opportunity for muscular influence in its relation to the individual tooth movement. The expansion arch, which for so long a time was our mainstay is in my opinion, in the light of recent years of experience, a more or less troublesome appliance; especially in regard to its effect upon the normal action of the lips and cheeks, and most noticeably so when it is poorly adjusted as is most often the case. It will be seen that this application, even when neatly accomplished, interferes and forms a barrier between the lips, cheeks and teeth so that their normal function is seriously interrupted.

It has not the virtue of being provided with a compensatory force such as may be found, for instance, with the pin and tube appliance (Fig. 3). Unfortunately, the pin and tube appliance in its most useful form is difficult for many to construct. Its various forces, compensations and reactions are so imperfectly understood, that for many, its successful use seems difficult. The most generally satisfactory appliance that I have found, especially in the treatment of many young cases, is the lingual wire (Fig. 4) which, when properly understood, applied and manipulated, forms an almost ideal agent for painless development. With this form of appliance the lip and cheek functions are not interfered with in the least. *Its employment gives the greatest encouragement and opportunity for the valuable assistance of properly prescribed exercises.* Its interference with the functions of the tongue is very slight, if it is properly ad-

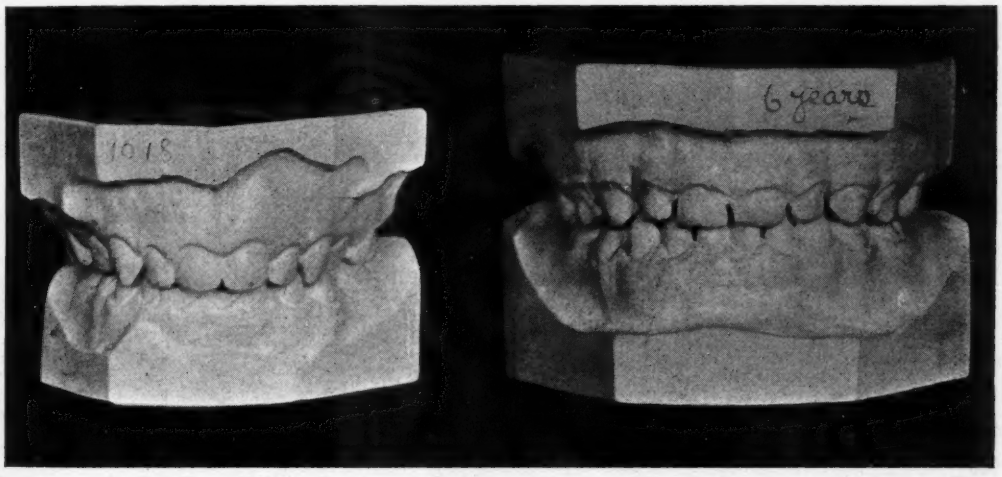

Fig. 6.

justed, and the individual teeth are free to develop normally with the exception of the molars. But it has its advantage even here, as its attachments afford a direct means for the control of the molars (Fig. 5), and is especially valuable when rotation is called for. It is good practice when practical, to remove this form of appliance during the period of molar drift, or else to apply some compensating force such as may be given by weak intermaxillary elastics. In some cases it is possible to stimulate development of the upper arch by producing a slow progressive development of the lower, by use of the lingual wire, causing adjustment of the upper by a system of exercises designed to stimulate the upper.

It is my purpose tonight to carry you rapidly through stages of treatment from the abnormal to normal in the deciduous dentures. From there through the period of transition to the attainment of the normal in the permanent dentures, touching lightly on the principles involved in the development, and its most efficient means of retention.

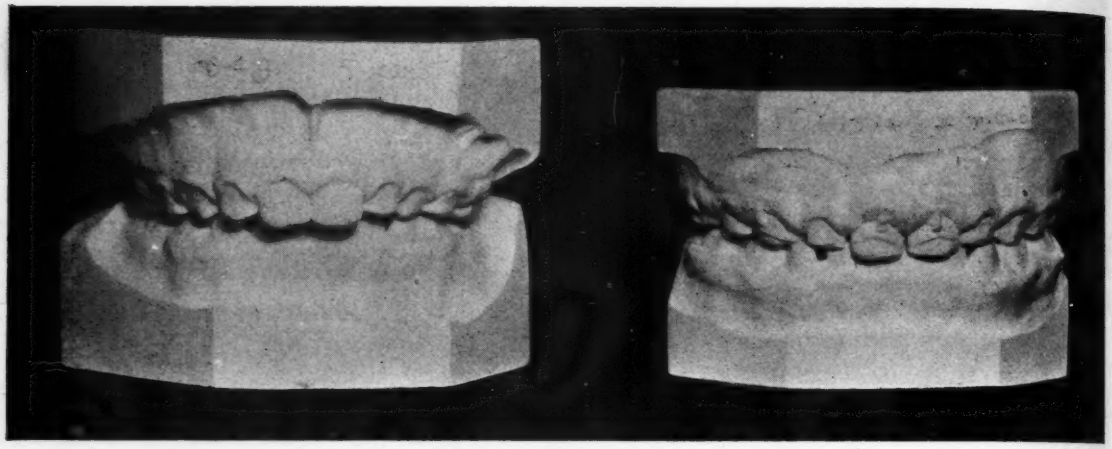

Fig. 7.

Fig. 8.

Fig. 9.

STUDY OF CASES FROM PRACTICE

My first picture (Fig. 6) in this series shows the abnormal deciduous denture of a child of six. You will notice it is a class two case with the period of the normal interdental development past, without the appearance of the normal interdental spaces. The distal position of the mandible is due only to the interference caused by a restricted upper arch which has hampered the pterygoid muscles in their efforts to adjust the mandible to its normal position. The right of this picture illustrates the normal development of another child of six years of age. It is a good example of perfect bone development and normal mandibular placement.

Our next picture (Fig. 7) illustrates a child of five with the same form of malocclusion which we have just studied, and which has been successfully corrected by careful and slow development of both arches. The upper, by means of a delicate pin and tube appliance; the lower, by means of a lingual wire. The mandible readily took its normal position when the treatment had progressed far enough to remove the interference. Figures 8 and 9 illustrate the occlusal views before and after development. Those of you who are acquainted with the normal deciduous arch will readily recognize the normal curve which has thus been produced.

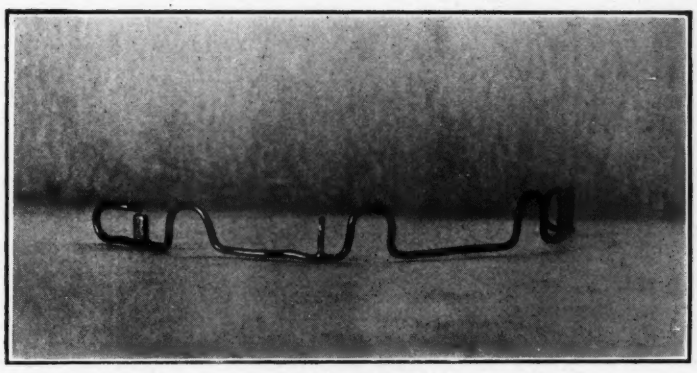

Fig. 10.

The next (Fig. 10) illustrates the appliances used in this development, that of the junior pin and tube appliance and lingual wire. These forms of appliances I wish you to carry in your minds during the remainder of our study of cases before and during treatment. These appliances, with modifications, were used in all cases which will be described until we reach the full eruption.

The next case (Fig. 11) in many respects is similar to the one just shown, except that there did not exist in this malocclusion of the deciduous teeth sufficient interference to cause distal position of the mandible. One of the remarkable features of this case is that the child in every respect presented the characteristics of being under six years of age, although she had passed the age of seven and a half years before the first cast was made. Another feature which I wish you to notice is that the deep overbite has been readily corrected during the process of developing both arches to their normal shape and size. The

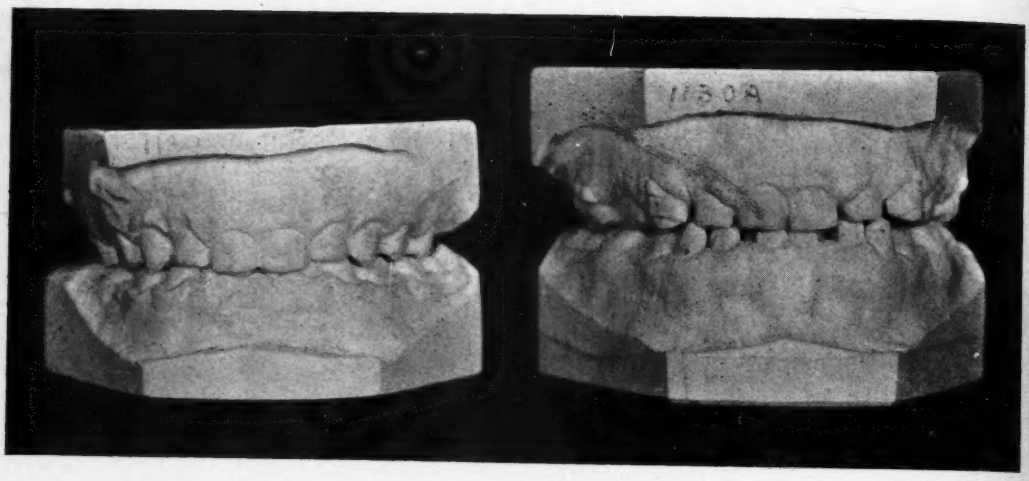

Fig. 11.

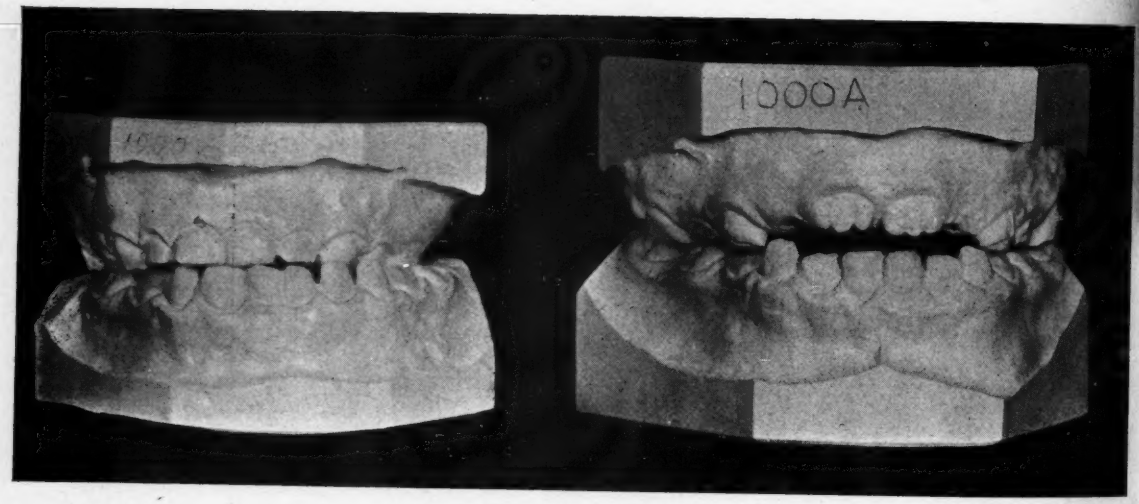

Fig. 12.

Fig. 13.

figure on the right represents the same case in its normal development, corresponding to the physical development of the child. Lingual wires and exercises are the remaining elements of treatment, except as treatment might be required to control the individual teeth during their eruption.

Fig. 12 is another case of special interest, as it shows the curious position of the mandible, presenting the unilateral, buccal placement of the lower, the

Fig. 14.

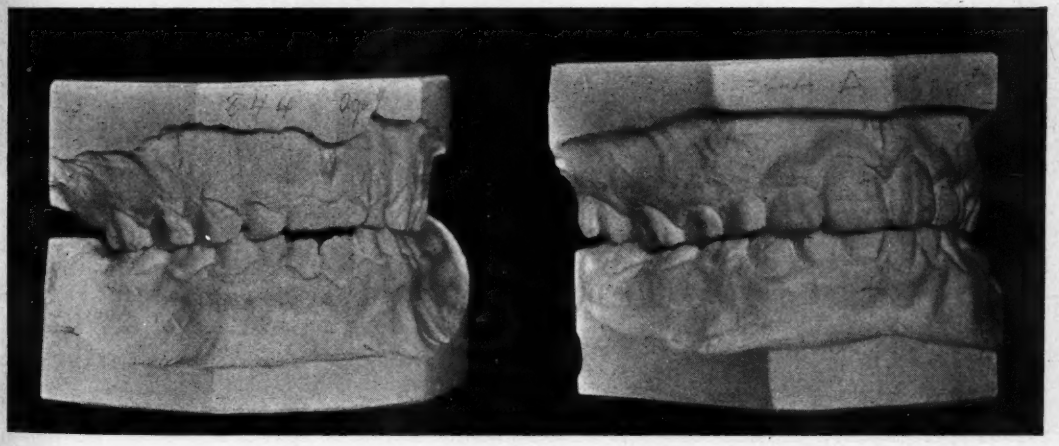

Fig. 15.

unilateral, lingual development of the upper being increased by the action of the inclined planes. The narrow arch made it impossible for this child to masticate with comfort. The movable mandible was, therefore, shifted for comfort's sake. The only treatment required in this case was the application of the lingual wire, and its progressive manipulation until the result seen on the right was obtained. In this instance satisfactory development of the lower arch took place without the application of an appliance. Permanent centrals

may be seen erupted in the upper with ample room on the left and right for the eruption of the lateral incisors.

The next illustration (Fig. 13) shows the occlusal view of the upper arch, and in my judgment shows a correct and harmonious arch development.

I shall now show a case (Fig. 14) similar in its nature to the one just seen—having the same characteristics of the lateral position of the mandible

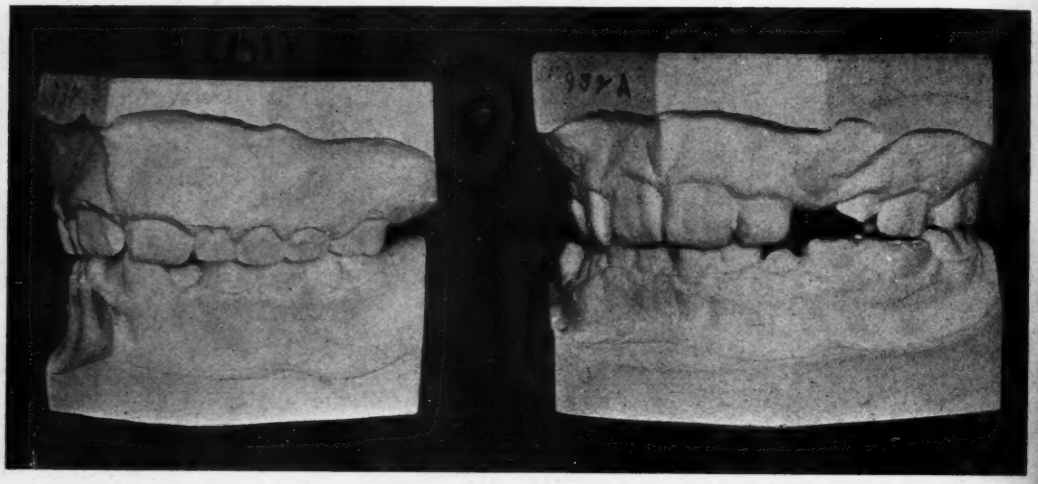

Fig. 16.

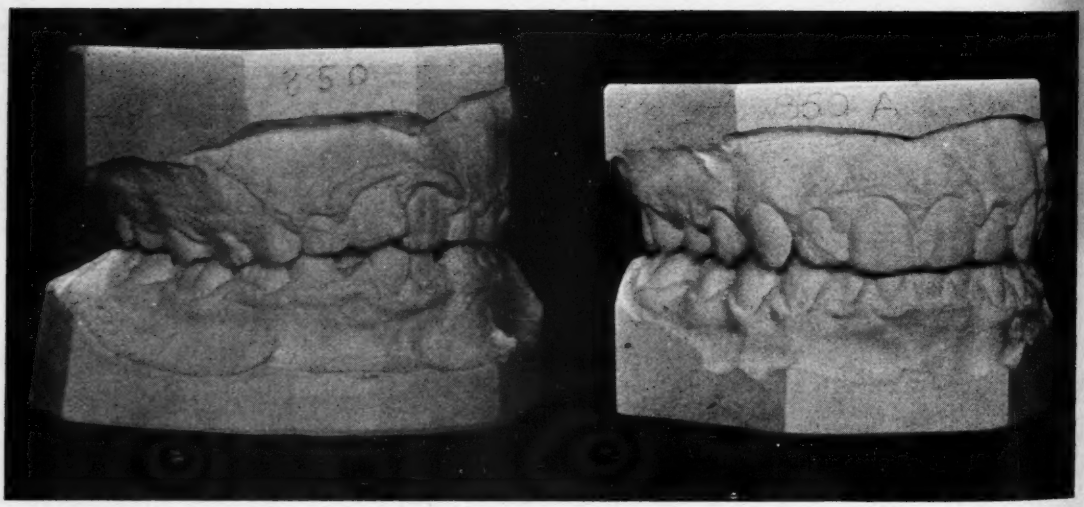

Fig. 17.

caused by interference. It is my purpose with this one to carry you over a lengthy period of the development, to show the contrast between the early deciduous and the almost completed permanent denture. The various stages of treatment through which this case passed during the transitionary period, were interesting, but can not be dealt with in this paper in detail. It is sufficient for me to show you the satisfactory arrangement of the permanent teeth, and call your attention to the fact that no further efforts are required except

those of nature in placing the upper left cuspid and lower first bicuspid in normal contact. Exercises which will be described are indicated and practised during closing months of active treatment of this case. It will be interesting for you to know that this development was attained by the application and use of the lingual wire alone.

The next case (Fig. 15) is a sister of the one I have just shown, and its history may be briefly told. The normal development of the arch was obtained by the use of junior pin and tube appliance. The child was under treatment for two winters, and is now under observation during the so far satisfactory and normal eruption of the permanent teeth. The incisors have all appeared, as shown in figure on the right, and no further treatment will be necessary unless individual teeth become misplaced during their eruption.

The next case (Fig. 16) was similarly treated. The appliances are all

Fig. 18.

removed now excepting the lingual wire on the lower. The first biscuspid and cuspids are seen in process of eruption on the right.

Fig. 17 is of a child eight years of age, showing its insufficient development of the arches for the accomodation of both the upper and lower incisors. The pin and tube appliance was used with satisfaction on the upper, and the lingual wire accomplished the normal development on the lower. The child is now progressing normally without aid of mechanical interference.

I am glad to show you the development indicated in Figure 18. The child was placed under treatment at six and a half years of age. It will be noticed that there was room on the anterior segment of the upper arch for development of the central incisors only. On the lower the lateral incisors had erupted at this period, but were in marked lingual position. The case was treated in the manner described in foregoing cases. On the right is presented a completed permanent denture at thirteen years of age. You will notice the satisfactory

bone development and arrangement of the teeth which do not carry with them evidences of orthodontic interference.

The muscular development in this child was satisfactory. She grew, during the process of treatment, into a robust, athletic girl. In the matter of development, utility and beauty of contour, this case, as seen in the picture,

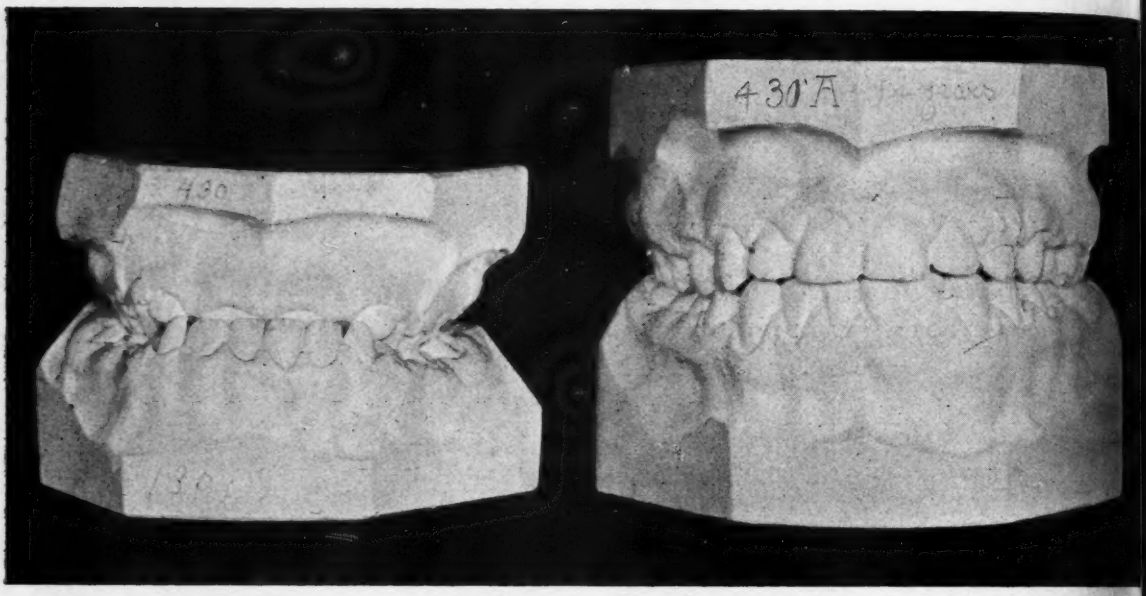

Fig. 19.

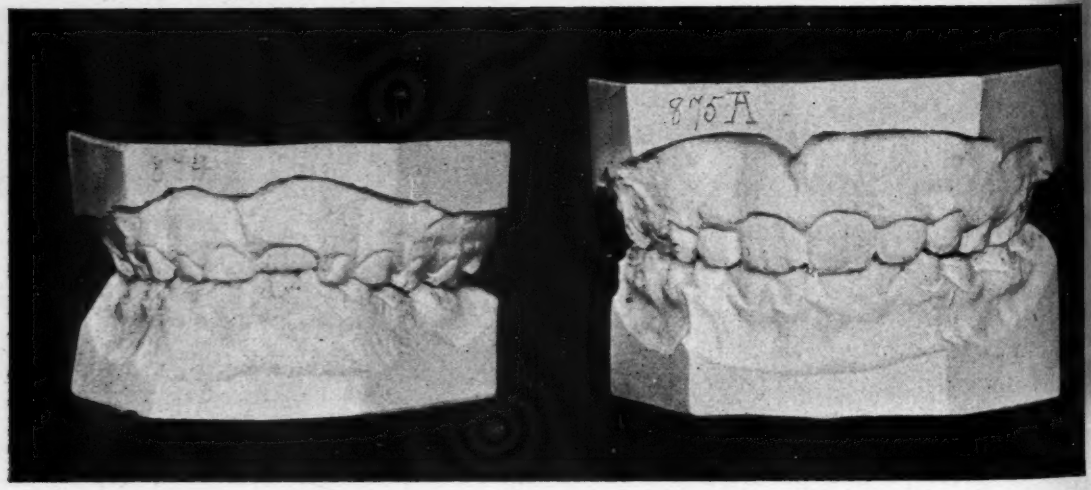

Fig. 20.

presents a most satisfactory and inspiring conclusion to the years of treatment.

The type of case here presented (Fig. 19) was one of unusual difficulty. Treatment was commenced the latter part of her eighth year. The model on the right was taken after completion of work, and many months after the removal of all appliances. The pin and tube appliance on the upper arch, lingual wire on lower, with some attachments for accommodation of intermaxillary

elastics, were used. It was difficult in this patient to produce sufficient bone development on the upper arch; in fact, the whole maxilla seemed to be deficient on bone growth, and most careful stimulation failed to produce as satisfactory bone development as it is possible to obtain in the matter of occlusion.

Fig. 20 is of a child eight and a half years of age, and like one of the preceding illustrations it represents tardy development. The child was small of stature and mentally active. The junior pin and tube appliance was adjusted to both the upper and lower arches. Figure on the right shows the marked bone

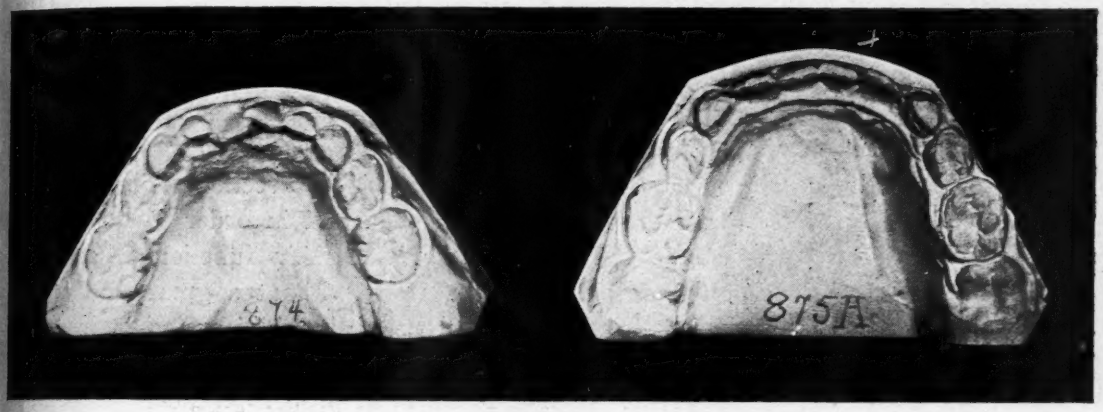

Fig. 21.

Fig. 22.

development and normal eruption of the incisors. When this point was reached the junior pin and tube appliances were replaced by lingual wires. The next, Figure 21, shows the occlusal surface of the lower. You can readily see the work accomplished without the employment of ligatures, or anything but the simplest of appliances. The next slide (Fig. 22) shows the occlusal surface of the upper. The case has now progressed for several years in a perfectly normal direction, and will probably need little or no corrective treatment other than to see that the muscular tone is maintained.

All the illustrations that we have just been reviewing show malocclusions that lead to greater inharmony in later years. Insufficient growth of the bony framework is the obvious cause.

It will suffice, at this time, to recognize that this condition exists, that it can be corrected, and by what means corrections can be effected in the best and easiest way.

APPLICATION OF EXERCISES

It has long been taught and generally accepted, that after the teeth have been placed in their normal positions of occlusion, and maintained for a more or less lengthy period, retention is assured as far as that is possible. This is far from being the truth, because as already stated, unless the surrounding soft tissues are equally normal in development and action the bony structure supporting the teeth will be influenced in some undesirable direction. The muscles of the face must perform their proper function, and in order to do this they must be strengthened. Strong muscles perform their function without fatigue, and accomplish an unusual amount of work without a great deal of mental effort. It is important also that the posture of the child suffering from malocclusion be improved when needed. This is essential in more particulars than one and I am firmly of the belief that we need proper physical balance in all parts of the body to attain and maintain most desirable results. Posture has important bearing on the position of the mandible, and is of immense importance to general health and vigor. My plea for judicious exercises of the muscles of the face is, therefore, founded primarily upon common sense. By disuse, the muscles of the legs fall below their normal in strength until we are disinclined to use them, and after long disuse we find they will not support even the weight of the body. Yet these muscles are capable of being strengthened to such a degree that they are capable of supporting several times the weight of the body, and are even capable of performing extraordinary feats of strength. They do not shirk at the ordinary duties that are placed upon them when they are strong, but perform them with comfort and efficiency. It is just as true with the muscles of the face as with other groups of muscles. No group has received less attention regarding their proper development than the facial muscles. They have been before us so constantly, and are so intimately connected with the very essentials of our work that it seems strange to me that we have not investigated the means for their development before. It is very true that some of us have thought and expressed ourselves as believing that disuse is largely responsible for malocclusion, but we have been at a loss how to remedy this weakness. Drs. H. K. Hatfield and A. LeRoy Johnson (*Dental Cosmos,* June, 1917) after a series of investigations, have found that the muscular strength of a child suffering from malocclusion is below that found in the normal child.

I have reached the conclusion that the mouth will not perform its full duty until these muscles have been strengthened, and the teeth are in such good occlusion that it requires little or no conscious effort for the masticatory

muscles and teeth to perform any task within their function that may be given them. In order to create in you a sense of the possibilities in this direction, we are going to make a brief study of the principal groups of muscles, after which I shall outline a few of the important exercises which I have found valuable in my work.

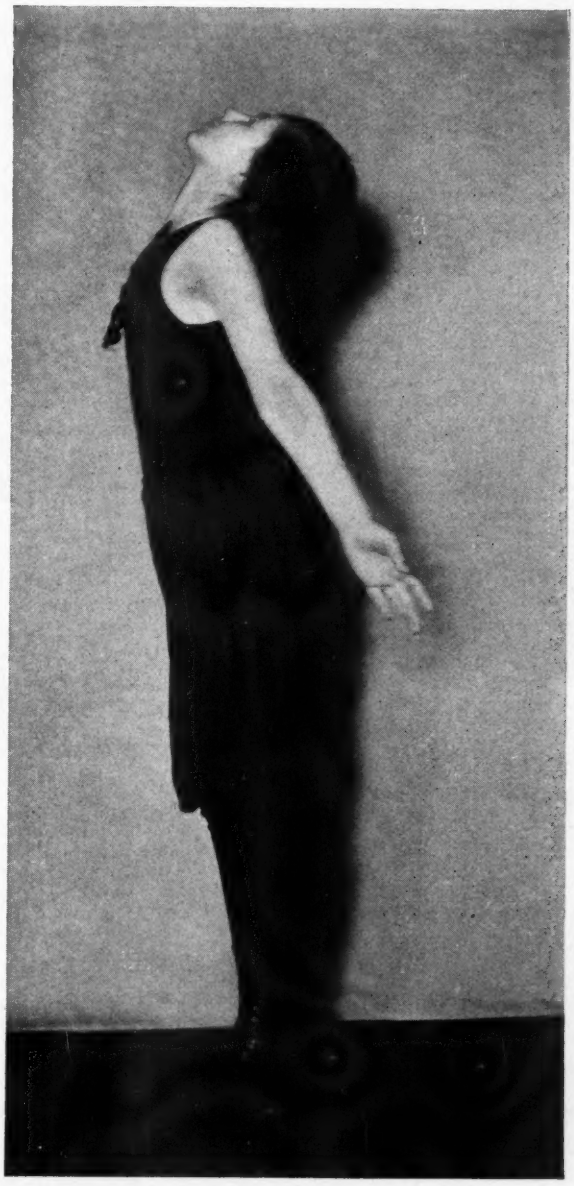

Fig. 23.

At the outset let me say that any system of exercises, in its application for the purpose of development of dental arches and facial muscles, must be carefully thought out and adapted to the exact requirements of the case under treatment. The masseter exercises, for instance, should not be applied to a case of malocclusion representing Class II until the interference has been re-

moved, or in other words until the arches have been developed to nearly their normal shape and size by mechanical stimulation, nor should the pterygoid exercises be expected to yield satisfactory results until interference has been removed so that the mandible will have some encouragement to settle into its normal position.

STUDY OF MUSCLE GROUPS

In our brief study of the various muscle groups we shall take time only to note their attachments and comprehend their principal functions. This will

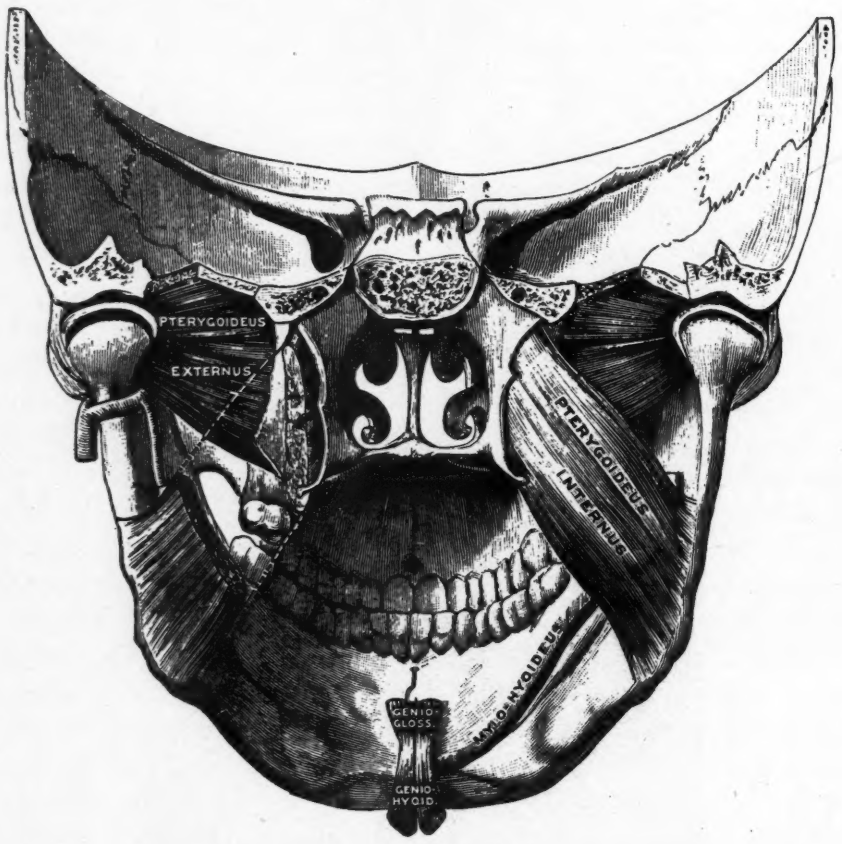

Fig. 24.

be sufficient, I hope, to make us realize quite fully the value of the suggestions relative to exercises, which I am to give.

The study of the smaller groups of muscles, although much may be said regarding their importance, will have to be postponed until some future opportunity. Their consideration would naturally come under the heading of "Facial Habits and Muscular Balance."

I have already reminded you that posture has an important bearing upon the muscular groups of the face, as well as upon the position of the mandible. Of course, we understand that correct posture (Fig. 23) has primarily its beneficent effect on the general health of the child. Whatever tends to place

the child in a more vigorous and healthy state aids the orthodontist in his work. Children who are suspected of being in need of orthopedic treatment should be recommended to consult the orthopedist for corrective gymnastics. It will not be necessary for me to discuss this matter further, although there is much I should like to say upon this subject. We will turn, at once, to the consideration of the principal muscle groups in which we are concerned, and outline briefly the exercises adapted to each.

PTERYGOID

The first group (Fig. 24) I shall select for consideration is the pterygoid group. This figure gives us a clear view of the points of attachment of these important muscles. It will be sufficient, for our present study, to note the

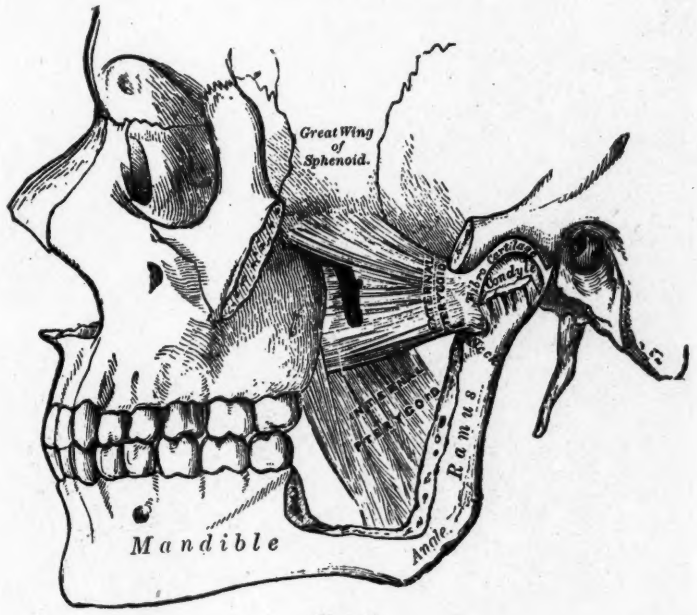

Fig. 25.

relation of the pterygoid fossa and the head of the condyle, and also of the angle of the ramus—the points between which these muscles are stretched.

This illustration (Fig. 25—Gray's Anatomy) shows in a clear manner the direction taken by these important muscles. They represent the invaluable intermaxillary elastics of nature, which, when properly strengthened by exercise during the process of development of the arches, soon offer us a guarantee of unusual merit for the permanence of our treatment.

The following photograph (Fig. 26) represents a subject much in need of the exercise of these muscles, and is one in which marked improvement has been noticed, as a result of faithful practice. The practice of these exercises is simple, and consists in the act of throwing the mandible straight forward as far as possible, repeating the movement until the muscle group shows slight fatigue. The exercise is practised several times during the day at stated intervals. It is especially valuable in Class II cases, and should be commenced

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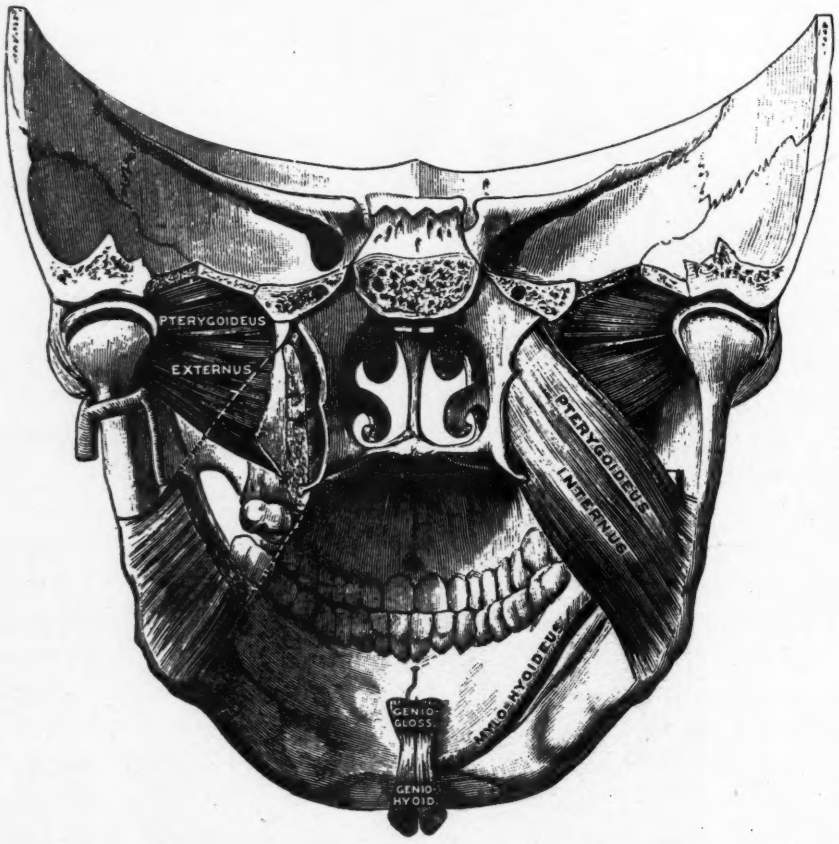

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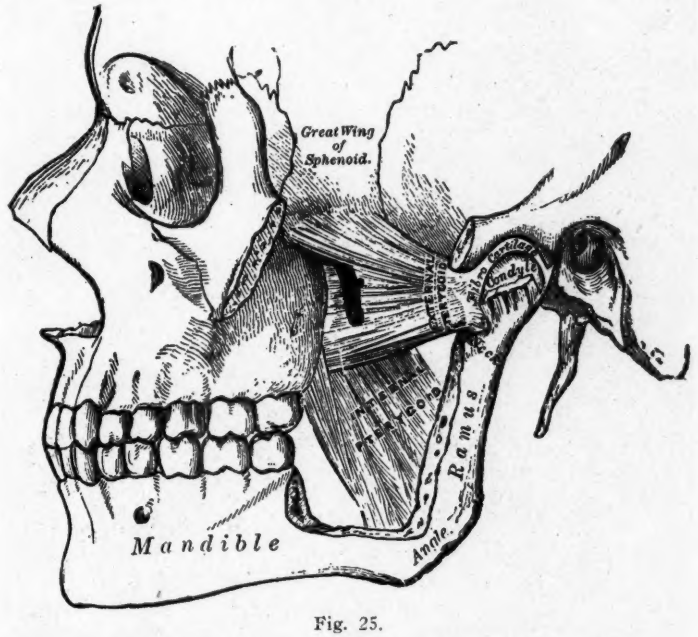

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a short time before the dental interference has been removed, or when the upper arch has been so changed as to permit the mandible to assume a nearly natural position.

MASSETER—BUCCINATOR—PLATYSMA

Figure 27 (Gray's Anatomy) reminds us of the attachment of these and various other groups of muscles. I wish you to note in particular the attachment of the masseter, buccinator and platysma myoides. The exercises of this

Fig. 26.

group of muscles are valuable during the period when the arches are nearing their normal in size and relation, or in any case when the harmony of the arches is such as to give opportunity for development through exercises. The exercise consists of first placing the teeth in their best possible occlusion, and with the mandible held immovable a series of contractions and relaxations of the masseter and temporal muscles are practised until these groups show slight fatigue. These exercises, like the pterygoid exercise, are practised at stated intervals during the day, but are increased each day until the patient is able to do them many times without fatigue. Results in many cases will furnish most satisfactory aid to the orthodontist.

For a more comprehensive idea and study of the muscle groups, the reader is referred to the later editions of Gray's Anatomy. Study should be made of separate groups with a view to studying the separate functions and tracing their interrelation. The study of the platysma myoides and its actions will be found particularly interesting.

Fig. 28 gives us the result of these exercises in closing the open bite, after a few weeks of practice by a child nine years of age.

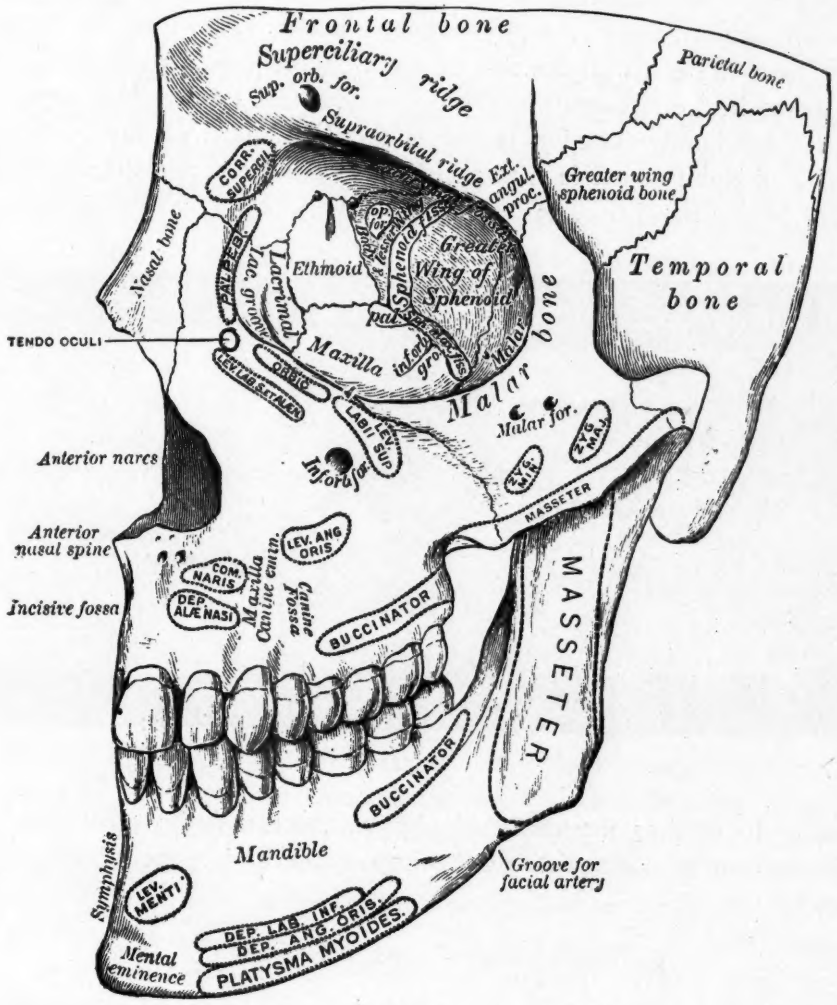

Fig. 27.

The stretching of the platysma muscles is one that must not be overlooked, especially in cases of Class II. The exercises for its benefit are found in combination with the general posture (Fig. 23) exercise, and is here illustrated. The child is directed to look directly above to the zenith, and then accentuating the position by carrying the point of the chin as far above as possible.

It may be claimed by some that little can be accomplished through exercises, because of the operator's inability to secure the faithful cooperation of the patient, but let me say that the art in this lies in making the children ac-

tually want to do the work recommended. Much better results can be obtained in this way than by simply telling them to do it. I have found in my experience, that once the child actually realizes the value to be derived that he is quite anxious to cooperate. Those who can not be so influenced must forego the blessing, but we must be sure the fault does not lie with ourselves.

We must go to primitive man for many physical ideals. He furnishes us with our standard of occlusion and we must not forget that he also furnishes us with other standards of physical development. As a people we have forgotten the importance of the physical, and in our mad efforts to develop the brain, we have neglected all the rest of the wonderful human machine. If we are to succeed in the strenuous battle to come, we must strive in every possible way to develop bodily function to the splendid standard of the perfect man. If we fail in this duty our life shall perish from the earth, and the works of our brain shall be for naught. The dentist in his various specialties is not without

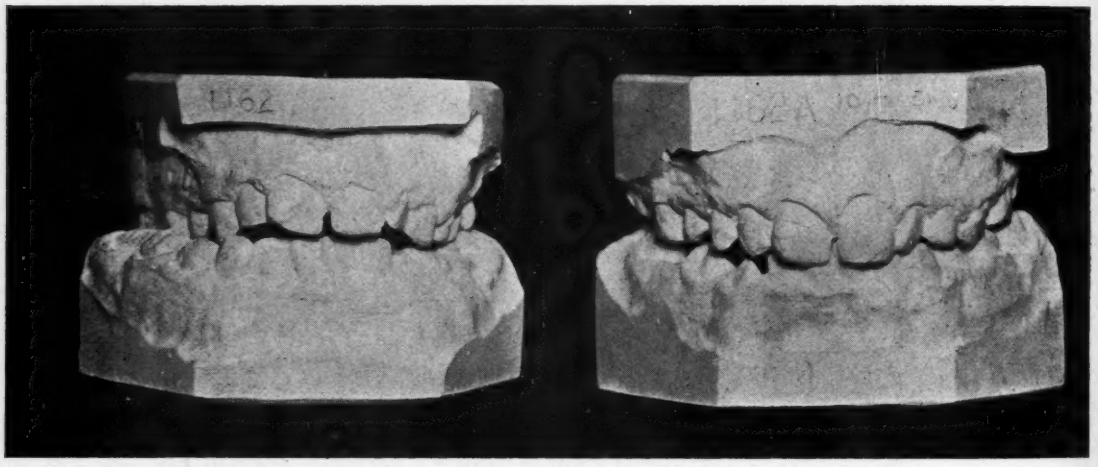

Fig. 28.

opportunity to further the cause of physical fitness, and we will do well if we gain the proper conception of the importance and scope of the field that stretches before us.

PSYCHOLOGIC CONSIDERATIONS

The successful practice of orthodontia depends not only upon the treatment of teeth and bone and muscles and the skilful manipulation of appliances, but upon the psychologic knowledge of the operator and the mental condition of the patient. In the whole wide range of corrective treatment there is no department that so requires the cooperation of the patient. This is primarily true because of the length of time required for treatment, and because the success is not dependent upon the more or less certain action of drugs when the patient is under close observation of the practitioner, but upon the development of somatic tissues over a considerable period of time when the patient would be under regular but not constant supervision. This means that for weeks

or months at a time the results depend upon the fidelity of the patient to carry out important instructions, and the intelligent cooperation of the patient to see that no injurious habits are formed or harmful developments take place without being reported. The general treatment then is mental as well as physical and neglect of this phase is the cause of many failures.

If this is true in general it is much more true in detailed treatment. The patients are all children or adolescents, and it is a well-known fact that children are open to suggestions. *This suggestibility is often detrimental, and the task of the orthodontist is to make this factor his ally instead of his enemy.* All practitioners who have to deal with the teeth know that persons come to them with suggestion working against them. The suggestion is that the patient is to undergo a most painful operation. A large part of the pain suffered by patients in the orthodontist's chair has no organic cause, but is purely mental. The pain caused by the general suggestion of tradition and the particular suggestion of friends is of long duration and severe. It is the fear every second which is the most difficult to endure. As a matter of fact, only the most bungling orthodontist causes pain in its true sense, but it usually requires several treatments with the most skilful suggestion to remove entirely the fear of pain on the part of the patient. The mother with the best of intentions has done the injury, she instructs the child, "Now you must not cry if he hurts you," "You must be a brave boy," etc., so that the child readily takes the suggestion that he is going to a chamber of torture. Countersuggestions must be made to destroy these.

In general, then, the office room should be fitted up so as to be attractive to children—light rooms, bright decorations, furniture comfortable for children. The waiting rooms should be provided with books for children and youth, and a liberal supply of new and attractive games—so that the children will be delighted to come and loath to leave. The attendants should be instructed that the chief part of their duty is to be pleasant to the children—the whole office force should conspire to make the place attractive. The practitioner himself is the key to the situation in this particular, and must not allow anything to interfere with his good nature.

Two psychological laws for use in dealing with patients may now be stated. They are very simple but fundamental. *The first is that a person can not think of two things at the same time, the second is that normal suggestion should be indirect and positive rather than direct and negative.* These laws fuse and coalesce in successful practice.

In taking up the first law and its application to our subject, *let us recognize that while the mind may turn rapidly from one thought to another, only one has our attention at a time, and further, if our attention is absorbed by one idea, all other things are mentally absent.* For our purpose we might speak of our subject as "The Expulsive Power of Another Idea." Let us, for example, take the case of a person sitting in his room suffering most excruciating pain from toothache. Some one in the next room cries out "Fire." The sufferer rushes out, aids in extinguishing the fire, talks about the cause and the effects, and at the end of an hour returns to his room to remember that he had

had a toothache. The ache may return then, or it may be effectively expelled. The patient sits in the chair with mind filled with the thought of being hurt; the skilful practitioner talks of the games in which the child may be interested, the trip up the river, the presents received or expected at Christmas, the child's birthday—anything of a pleasant and absorbing character. With the mind filled with these things there is no room for the thought of pain.

When working about the mouth the suggestion may be such that the experience takes on a new meaning. It takes time and brains, and a certain amount of talent to make most skilful suggestions, but not sufficient attention has been paid to this phase of the work, the practitioner trusting to the inspiration of the moment rather than to preparation for his suggestions, or else ignoring the matter entirely. Remember that if the patient is thinking about your story or his game, his teeth are not paining, and if, as in orthodontia, there is no organic but only mental cause of pain, the pain is more easily removed.

The suggestion should be indirect and positive. *It is better not to mention pain at all.* You may assure the child, "This will not hurt." He may never have thought of hurt, but now that you suggest it he can not think of anything else. Or, on the other hand, if his former suggestion of pain is very strong even a touch to the teeth may be interpreted as pain, and your statement does not carry weight with him the next time. To say, "This will not hurt" is a direct suggestion and should usually not be used. Instead, say something like this, "A little girl who was here yesterday told me there is no place she likes to be so much as in this chair for she always has such a good time here; she likes to have me work with her teeth and wants to come as soon again as I can have her." The patient makes this his own application. Then the positive suggestion always outlines the new idea. If you tell a patient not to think of pain it is practically the same as telling him to think of it.

Not a little malocclusion is caused by bad habits, such as biting a pencil, sucking the thumb, etc. These habits may be so firmly fixed that they can only be cured by abnormal suggestion in the form of hypnotism, but very seldom is this necessary. Usually the active cooperation of the patient and a few skilful and positive suggestions suffice to cure these. Instead of telling a girl that she must not bite her pencil it may be sufficient to call her attention in a casual way to the fact that biting a pencil is a vulgar and dangerous habit because disease germs may be conveyed to the system in that way.

There is practically no branch of the profession so neglected as the psychological, and none that will bring greater returns to study and thought. This is especially true where children are the patients and where injurious suggestions have already been given.

DISCUSSION*

Dr. A. L. Swift.—Although I do not feel competent to discuss this paper, which has been so admirably presented to us, I will call your attention to a few thoughts which have

*The discussion of Dr. Rogers' paper was opened by Dr. R. Ottolengui of New York City, whose remarks, illustrated by a number of lantern slides, especially emphasized the importance of anatomical restoration of tooth forms in all dental operations. The points brought out by Dr. Ottolengui, and the slides used as illustrations, were all presented in a paper read by him before the Panama-Pacific Dental Congress in San Francisco, 1915, and are published in *Dental Items of Interest*, March, 1916.

occurred to me. One of these is the fact that orthodontists who have listened to this paper must feel that there are certain requisite attainments which, if they are to be successful practitioners of their specialty, are of paramount importance; for I think the paper of the evening is most timely, and if I were practicing orthodontia, I should want to take this paper when it is published and go to a quiet nook and study it over carefully to find out how many of these basic requirements I did not possess, and then strive diligently to improve my ability along those lines.

When we see, as many of us must have seen, lamentable failures after long and arduous periods of orthodontic treatment, we often ask ourselves why there is such a vast difference in the results obtained by some and those obtained by others; and after listening to this paper I think we can more easily answer that question. Few men have been more deeply interested in watching the wonderful strides made by this branch of our profession than I; yet we have only touched upon the borderland of the wonderful blessings to humanity which orthodontia will accomplish in the fullness of time. The muscle exercise as suggested by the essayist is, I think, most important. I was speaking to Dr. Rogers before the meeting, and he mentioned a method of exercising certain of the facial muscles by having his patients use a little bicarbonate of soda in water, and by using the buccinator and other muscles, forcibly driving the liquid back and forth and around the mouth with the teeth closed, using this one mouthful until the muscles become tired, then expectorating, resting a moment, and following it up again in the same way a number of times. This recalled to me that in the treatment of pyorrhea I have suggested the same method,—not for the muscle exercise, of course, but for the forcible driving of a liquid through all the spaces and through the pockets, thus helping to keep the spaces and the pockets clean. It is really wonderful how much force can be developed by constant practice with the mouth filled—not overfilled, but with the proper quantity of liquid.

I have no use for the syringe which Dr. Black suggested, as I find that by insisting upon the patient's practicing this use of the muscles the force with which a liquid can be driven through the spaces and pockets is sufficient to keep them wonderfully clean. One who has never tried it will be surprised by the results, particularly in cases where there is considerable loss of mucous tissue in the interdental spaces.

Normal occlusion and proper contact points, as well as the little grooves which Dr. Ottolengui so graphically explained to us, are most important; and in the treatment of pyorrhea the proper adjustment of contact points and the occlusion are essential to success.

I do not know that I wish to refer to anything else. I have not had the privilege of reading the paper. I simply had the synopsis which was sent to all the members and the essayist has covered the subject so thoroughly there is very little I can add.

Dr. Oscar Carrabine.—I should like to speak of the psychological part of Dr. Rogers' most excellent paper, as I believe the profession at large has paid little or no attention to the study of psychology.

For myself, I am convinced there is much in this field of investigation that we ought to know. It seems to me it is of the greatest importance that we should recognize man as a mental as well as a physical being and I shall make a few suggestions that may add something towards gaining a better understanding of this subject.

So much has been written and so many theories have been advanced that one is at a loss to know just how and where to begin, but for those who wish a better understanding of this subject, I would suggest a book written by Thomson Jay Hudson, entitled "The Law of Psychic Phenomena."

Dr. Hudson is, I believe, the first man who classified the human mind. He believed in the dual mind of man; that the line of demarcation between the two was clearly defined; that each was endowed with separate and distinct powers, and he distinguished the two by designating the one as "objective" and the other as "subjective."

The importance of a knowledge of the law of suggestion, its normal application and its effect upon the physical functions and senses of the body, is something that each and every one of us should know.

Dr. Leuman M. Waugh.—The paper to which we have listened this evening must be accepted by us as a sincere message based on successful practice. The simple and comparatively delicate appliances, by which the developmental changes have been brought about, is most pleasing. It serves further to prove that the more powerful forms of arch and the use of ligatures, about nonbanded teeth, which we formerly employed so generally, can be dispensed with. By this means, it is possible largely to overcome two very objectionable factors, one being the difficulty of cleansing the tooth surfaces about the ligature and the second and probably equally important, the irritation to the gum margin.

For, after all, the subgingival space should be most carefully guarded in all treatment of the mouth; and the orthodontist should be especially careful not to bring about wounds of the free margin of the gum. I presume the essayist uses the lighter arch wires—about .030, as Dr. Angle recommends, in his pin and tube appliance, and that is probably sufficient to bring about any changes necessary at the proper age for treatment. I believe we must more and more recognize that our purpose can be better served with such appliances as interfere as little as may be with the individual movement of the teeth during treatment.

As to the age at which orthodontic treatment may best be given, although no age was mentioned, many of the slides showed that it was begun early, some at the tender age at which the natural spacing of the deciduous teeth should take place, which is at from three and one-half to six years. The general rule is that treatment should be begun as soon as a deformity becomes sufficiently pronounced to be apparent that Nature can not correct the condition without aid.

Between the eighth and twelfth year, the greater change normally takes place; and by aiding at a period when Nature is bringing about the greatest developmental change, we are working more in harmony with the physiological forces.

I agree with Dr. Swift when he says that all dental practitioners should be interested in this subject, and I further feel that all of us should really study this paper.

The work of the general practitioner and orthodontist should go hand in hand. An orthodontist has the little patient for a few years only, and then the patient is returned to the exclusive care of the general practitioner, we hope, with teeth in good occlusion and with facial harmony. But as Dr. Ottolengui emphasized, no matter how well the teeth may have been placed in proper position, no matter how carefully the orthodontist has done his work, that nice work may be disturbed most easily by restorations not made upon the principle of normal occlusion harmonized with the conditions present in the mouth at the time. Therefore, by all working in harmony, and criticizing each other kindly—and only kindly—may we hope to attain to a higher grade of "all-inclusive" dental service, which must be the ultimate aim of every sincere practitioner whether in general or special practice. And the essay of this evening, if we will study it thoughtfully, should be helpful to this end.

Dr. Rogers.—I am glad that Dr. Ottolengui supplemented my paper by his very timely and interesting suggestions. I think that every orthodontist has recognized the importance of his subject, and is desirous of awakening a sense of duty in this respect among the general practitioners.

I enjoyed the other discussions and appreciate and agree very heartily with what has been said. If any of you should study and undertake the work of muscular development of the facial muscles, you must not become discouraged if you do not get results at once. It is a comparatively new field, and the application of the various exercises must only be made after careful study, and thorough understanding of what is required. Some thoughtless people might prescribe exercises where the conditions present called for some different line of treatment. I believe the orthopedic surgeon will, in the future, prove to be of great benefit to us in our work. In cases not needing his attention, the general posture exercises can not fail to be beneficial. Parents appreciate their value, and children like to do them. These exercises tone up the whole system and improve the digestive apparatus; and they stimulate greater mental activity. The patient gains greater respect for himself. Children are ready to help, if we are willing to explain the exercise properly. Tell them they will grow vigorous and strong, and few will fail to take interest in the idea.

THE HISTORY OF ORTHODONTIA

(*Continued from page* 250.)

By Bernhard Wolf Weinberger, D.D.S., New York City

JOHN NUTTING FARRAR (1839-1913) Father of Modern Orthodontia. At just what age Farrar became interested in orthodontia, historians have failed to enlighten us. From the following lines, written by this great pioneer himself, we presume it must have been very early in youth for he says, "The first regulating operation performed by the author was upon one of his own upper central incisors, when he was a small boy. This outstanding tooth was moved into line by pressing his finger upon it several times a day for several weeks." It matters little whether this was the beginning, or the cases reported

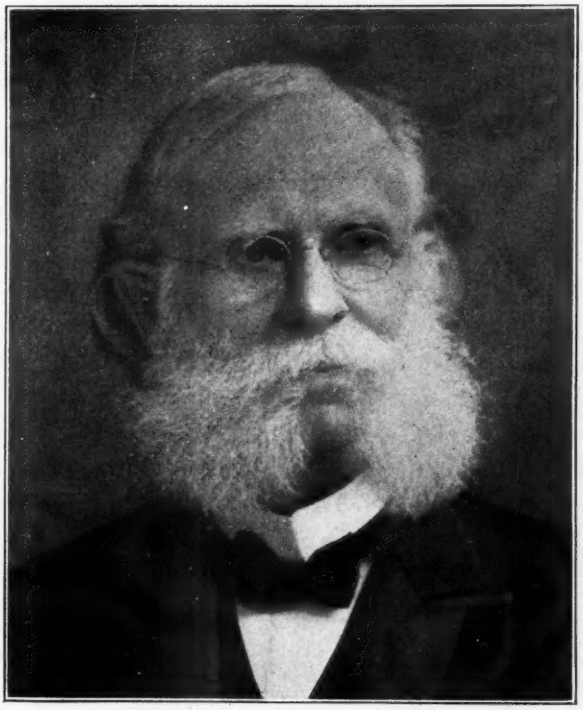

Fig. 1.—John Nutting Farrar (1839-1913).

in 1872-3, we nevertheless find the year 1875 the turning point in his professional career for at that time he began to publish the results of his experiences and experiments. From a crude beginning we find later evolved the first, of the many, systems in Orthodontia.

Before the Brooklyn Dental Society, April 12, 1875, Farrar read the first of his many papers, the title of which was *An Inquiry into the Physiological and Pathological Changes in Animal Tissues in Regulating Teeth.* This series of articles some thirty-eight in number he later published under the title of *Regulation of the Teeth Made Easy by the Positive System.*

These are to be found principally in the *Dental Cosmos* and were sharply criticised by his fellow-copractitioners. However, in time, those who were the most prone to condemn, were his staunchest friends.

This first distinct "system" of regulating teeth was based upon the screw as a motive force. His ideas were far in advance of his age, most of his papers "were constructed to serve a double purpose; namely, to set forth some esthetic or theoretic principle and to illustrate the application of the same to practice." The underlying principle of his work is found in the preliminary chapter, vol. 1, page 13, of his work.

"One of the cardinal principles, especially advocated in this work, is the importance of the observance of the physiological law which governs tissues, during a movement of the teeth (by means of art), the object being to prevent pain. To insure this result (exemption from pain), the pressure by which the movement is to be effected should be under the control of the patient, a requirement which implies the use of instruments capable of being operated and adjusted at will. By this maximum rate at which it is possible to move teeth painlessly can be ascertained. But while the system expressly advocates the use of 'controllable' mechanism, and of intermittent force, when practicable, the assertion made by hostile critics, that the use of continuous force, is wholly disapproved of, under all circumstances, is untrue.

"The idea of taking advantage of the functional laws of the tissues to prevent pain, appeared to me (at the time of its conception) novel, and yet so rational that, when fully appreciated, it would be available in general surgery as well as in dentistry. To determine this rate and test its value, I made a series of experiments which extended over a period of several years. The results were made known to several professional gentlemen in 1873; and in February, 1874, this topic was the subject of my graduating thesis at Jefferson Medical College, and afterward read in the main before the Brooklyn Dental Society, April 12th, 1875, and published in the *Dental Cosmos,* January, 1876."

Dr. Farrar was the originator of the broad theory of *Intermittent Force* in regulating teeth, this being considered not only the proper method physiologically but also proving the most effective one.

In 1888 Farrar, after fifteen years of conscientious labor, gave to the profession what was undoubtedly, and still is, the greatest work ever issued on orthodontia. Too much honor can never be bestowed on him for these two volumes, the third never having been published. His *Treatise on Irregularities of the Teeth and their Correction* contains over fourteen hundred pen and ink sketches, drawn by the author himself, and has some fifteen hundred and seventy pages. These volumes are a veritable mine of orthodontic knowledge, epoch making in character and more than profitable reading to those engaged in this specialty. This great work was founded upon the results of active experience carefully recorded from 1863 to the publication of the work.

The author's aim in these volumes was to make every appliance self-acting, at the same time the dynamics being such that the patient would be practically unconscious that "regularity was taking the place of irregularity in the mouth." In regard to the force he adopted in his "system" Farrar says, "When I first made the broad statement that the screw was capable of being used in more

forms than that of the screw jack, and that the screw might be made to play an important part in the correction of nearly all conditions of irregularity, the assertion was said, by many, to be absurd. Even the screw jack now admitted to be adaptable to many conditions with wonderful results, was then thought to be capable of very limited service."

In regard to the effect of forces, Farrar says, Vol. II, p. 758,

"Teeth will move in any direction by force continuously maintained, or frequently repeated for a sufficient length of time. The force may be within the tissues of the jaws, as exemplified in cases where liberty, by extraction of an interfering tooth, is followed by natural adjustment of the obstructed tooth, but perhaps it is more satisfactorily shown in cases where the force is furnished by the finger, or is obtained from a machine. The first aim, however, in any operation for the movement of a tooth is to cause slight looseness, by more or less decalcification of its socket-tissues, a condition that results from pressure of the tooth upon these tissues. This softening of the socket breaks the fixedness or rigidity of the tooth, leaving it comparatively easy to be moved either by absorption of the tissues or by bending of the alveolar process, or by both.

"The proper correction of teeth by machines lies in applying the force in the right direction and in a philosophical way. To elevate teeth in their sockets, the direction of force applied is similar to that for extracting them, the difference in results depending upon the amount of force applied in a given time. For movements in other directions, philosophy is also the basis. Teeth can be moved in any direction by brute force simply, but to move them in the best way depends very much upon a high quality of intelligence behind the hand.

"If these facts are clearly understood, it will be seen that to move a tooth, all depends upon applying a proper degree of force; and to successfully regulate a tooth, by any of the various plans, depends not only upon furnishing force, but upon applying the engine of force so that it will bear or draw upon the right place. If the object is simply to elevate the tooth, all that is necessary is to cause the force to act in the line of its long axis, and in the direction of the end of the crown; but if the object is to move the crown posteriorly or anteriorly, the force should be applied so as to act at right angles (or nearly so) to the long axis of the tooth.

"Thus far we have gone along the lines of general principles; but there are several related factors that cause deviations from these general lines in operations upon the front teeth (especially the upper), that should be taken into consideration. These deviations are caused by the socket resistance acting upon these teeth (being moved) like fulcrums; that is, some of these teeth tilt upon places somewhere within the middle third of their long diameter. [Page 765.] To move both the crown and the root bodily forward (sometimes necessary in elongating the dental arch) requires the application of forces that will act in opposite directions; or, perhaps more clearly expressed, the mechanism must be so constructed that the crown can be held firmly and given gradual liberty to move forward, as the root is made to move forward.

"Brief of Author's Theory.—Teeth are moved through absorption of the socket-tissue, or by bending of the alveolar ridge, or both. This absorption, or this bending, may take place by the tissue alterations being carried on within

their physiological functions, or outside of these healthy functions and in the pathological. If the tissue-changes can be conducted within the physiological functions, the operation of moving a tooth will be painless; but if the rate of changes be pushed beyond this condition, into the pathological, there will be more or less pain.

"Any regulating mechanism that can be controlled so as to confine the tissue-changes within the healthy line is therefore superior to those that can not. Mechanisms that operate by elastic rubber or by metallic springs, if the power is not so great as to force the changes to exceed healthy action, will be comparatively painless; but to control elastic materials so that they will not cause pain is generally difficult and often impossible.

"This is not the case when mechanisms operated by screws can be used, because by the screw exactness can be secured, and precisely the proper degree of force can be given. Especially is this true when the management of the mechanism is left to the patient, who knows better than the operator when the greatest degree of force can be given without causing pain. This desideratum is assured by the screw making it possible to take advantage of the law of labor and rest, which applies to this kind of tissue-action as well as to all other tissue-energies."

At a banquet given him by his friends in 1908, Farrar explained his position as to specialties in dentistry, in a way worthy of remembrance. He said, "I regard the profession of dentistry as equal to any profession in the world. Is there any profession or any branch of medicine that can relieve the amount of pain and suffering that we do? I think not. I have always made my study of the profession as a whole, and am an all-around dentist today, have practiced every part with equal knowledge. I have no specialty, unless all the branches are specialties and altogether amount to a great specialty called dentistry. I can not understand how any one can undertake to be a specialist in dentistry who is not an all-around dentist. . . . I advise young men to learn all branches of dentistry equally well, and never give up the other branches to follow a specialty. If a dentist thinks he can follow a certain line better than any other, he can get a reputation as a specialist, but no man can treat a particular branch successfully unless he is a master of every branch of the profession beforehand."

The following prophecy from the pen of Dr. Farrar in the *Dental Cosmos,* January 20, 1878, has been more than fulfilled and illustrates the farsightedness of this great thinker.

"Although the simplification of regulation has been a great desideratum for many years, it has for some time been evident to me (though by most people thought to be impracticable) that the time will come when the regulating process and the necessary apparatus will be so systematized and simplified that the latter will actually be kept in stock, in parts and wholes, at dental depots, in readiness for the profession at large, so that it may be ordered by catalogued numbers to suit the needs of any case. So that by a few moments work at the blow-pipe in the laboratory the dentist may be able, by uniting the parts, to produce any apparatus, of any size desired, at minimum cost of time and money." The importance of this prediction was not readily grasped at that

time, but today we are fully aware of the results of this standardization of orthodontic appliances.

Farrar also realized the necessity of bringing about a new arrangement of the two dental arches so that normal articulation would result. His devices were far too numerous and the complication of their character undoubtedly prevented their general adoption.

Under *An Inquiry into Physiological and Pathological Changes in Animal Tissues in Regulating Teeth, Dental Cosmos,* 1876, page 13, we find, "In some cases the correction is easy and simple, producing little or no pain or inflammation; in others the operation is difficult and tedious, accompanied by pain and inflammation. Are these differences owing entirely to a difference in the constitutions of different people? or do they mainly lie in the *manner* the operations are performed?

"This led me to consider various well-known operations in surgery and it appeared evident that all of them which depend upon pressure, such as dilating strictures, ligation of tumors, and regulating teeth, involve and are subject to much the same physiological laws. To illustrate the operation of these laws in one class will explain my idea of all.

"The treatment for regulating teeth was instituted for correcting a defect where the eruption had taken place in a crowded, irregular manner in the arch, producing deformity of the features, incorrect articulation of speech, lisping, imperfect mastication, etc.

"In moving teeth, the slight inflammation of the alveolar process at the point in the socket in the rear of the departing teeth, causes in the same way (so far as we are able to judge) a deposit of cartilage material in the space left.

"It will be seen that in this act or movement of a tooth a double physiological operation is going on,—absorption on one side and deposit on the other. Exactly how this absorption takes place is not well understood. First, pressure is a primary cause, and absorption the result. These are facts we all can see.

"As it is so common to theorize, I may be pardoned if I give here my views. The pressure of the tooth upon the soft alveolar process, or socket, causes more or less devitalization of the contiguous cells, which are broken down and carried off by the absorbents, which possibly are somewhat stimulated by the slight inflammation acting upon them through sympathy from contiguity and continuity, while the advancing tooth, interfering with the blood nutrition, prevents new cells taking the place of old ones. Thus the tooth moves as fast as the cells give way before it. In other words, the tooth advances by 'displacement.'

"On the opposite side of the tooth the reverse of absorption is going on. The tissues are constantly separating, and the space between the departing tooth and the socket-wall is filling with new cells, formed from the exuding plasma.

"In the treatment for regulating teeth, the operator meets many obstacles, especially in the construction of apparatus to obtain desired results. The

great desideratum in his mind *has* been to *move the teeth,* without much regard to physiological laws.

"Teeth may be moved in any direction from one-fourth to one-half inch, and in some cases even more. Generally they are moved laterally, but may be depressed or raised in their sockets. The principal apparatus, except those on the inclined-plane principle, is, and always has been (since this branch of the profession has been vigorously prosecuted), made of rubber, so secured to the teeth by ligatures and metallic bands as to keep up a constant tension on the tooth to be moved. This constant traction, after a day or two, starts the tooth from its old home a very short distance. It continues to move slowly

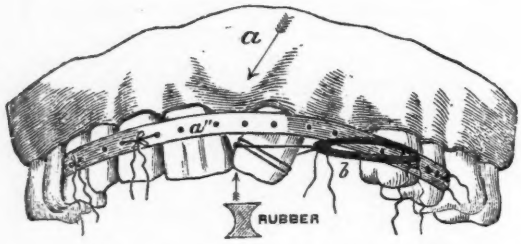

Fig. 2.—One of Farrar's first cases, treated by the rubber plan (1876).

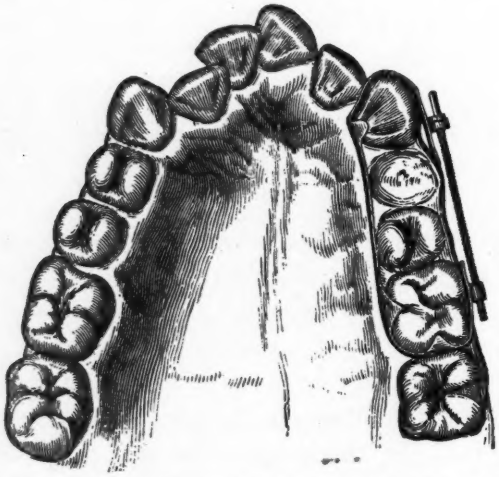

Fig. 3.—Represents the first step for treatment with the gold band and screw applied (1876).

from day to day, from week to week, as long as the tension is maintained, the apex remaining comparatively stationary as the crown advances.

"It is found that the unfavorable cases are those in which the tooth has been moved a considerable distance, the operation having been accompanied by much inflammation and pain, as before mentioned, while those moved but slightly have caused little or no pain or inflammation, requiring but short treatment. Therefore the difference must arise from the degree of tension, or length of time, or both.

"From these considerations, it will be seen that undue pressure upon the tissues will, if allowed to remain too long, produce inflammation, and will also modify or arrest the action of the absorbents, and all together produce unhealthy changes in the parts involved. On the other hand, tissues can receive

a moderate amount of pressure, causing absorption, and yet not passing beyond healthy action. Therefore there *must* be a dividing line within which we may operate successfully, and beyond which we can not."

One of the first cases Farrar treated is shown in Fig. 2 and represents a specimen in his cabinet, treated by the rubber plan; *a* represents position of the left central incisor under the gum, erupting six years after the mate; *a,"* gold band; *b,* rubber ring, under tension; the ligatured tooth is a left lateral incisor in contact with one right central incisor.

A very thin gold band was fitted around the cuspid (Fig. 3) and extended back along the lingual surface and around the first molar tooth, leaving a space between the ends of the gold strap on the buccal surface of about six-eighths of an inch. On each extremity of this strap of gold, at right angles, was soldered a nut, through one of which was cut a screw-thread. Through these nuts passed a screw one inch in length, having sixty threads; the screw being fitted at the anterior or mesial extremity for a watch-key. (Fig. 4.) This simple apparatus having been applied, the screw was turned so as to cause a slight sense of tightness, or pressure, but not enough to produce pain. This sense of tightness passed away after about an hour, leaving no unpleasant feeling whatever. Even the instrument caused little or no inconvenience. The

Fig. 4.—Represents the simple band and screw with a key applied (1876).

screw was turned one-half of a revolution morning and evening,—thus advancing it one-half of a thread, or 1/120 of an inch by each operation, or 2/120 of an inch per day.

"It should be borne in mind that the gold band had but one screw; consequently, when it was advanced 1/120 of an inch, the tooth only moved half that distance, or 1/240 of an inch, at each operation, and, as the operation was performed twice every day the tooth moved 2/240 of an inch, or 1/120 of an inch per day.

"From these experiments we deduce the following conclusions:

"1st. That in regulating teeth, the traction must be intermittent, and must not exceed certain fixed limits.

"2d. That while the system of moving teeth by elastic rubber apparatus is unscientific, leads to pain and inflammation, and is dangerous to the future usefulness of the teeth operated upon, a properly constructed metallic apparatus, operated by screws and nuts, produces happy results, without pain or nervous exhaustion.

"3d. That if teeth are moved through the gums and alveolar process about 1/240 of an inch every morning, and the same in the evening, no pain or nervous exhaustion follows.

"4th. That while these tissues will allow an advancement of a tooth at this rate (1/240 of an inch) twice in twenty-four hours, the changes physio-

logical, yet, if a much greater pressure be made, the tissue-changes will become pathological.

"The Law. In regulating teeth, the dividing line between the production of physiological and pathological changes in the tissues of the jaw is found to lie within a movement of the teeth acted upon—allowing a variation which will cover all cases—not exceeding 1/240 or 1/160 of an inch every twelve hours."

In the *Dental Cosmos,* 1877, page 519, under *Rotating Teeth in Their Sockets in the Process of Their Regulation,* Farrar stated:

"The main points necessary in the successful regulation of teeth are, firmness of application of the instruments and minuteness of the apparatus, in order to facilitate management and secure the ease and comfort of the patient.

"Clumsiness of apparatus is a great stumbling block to the success of operations as well as the reputation of dentists. The idea of a wrench application is not new, though original with me. Dr. Atkinson has used something of this sort, made after the shape of an old-fashioned, long handle dipper, fit-

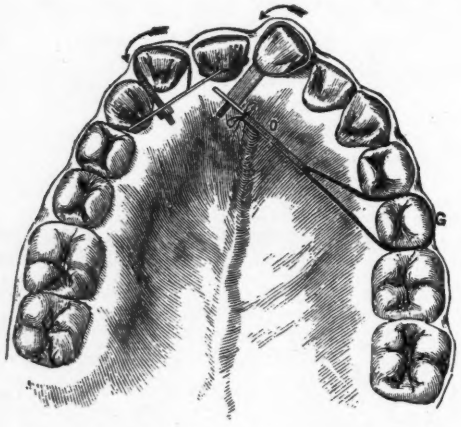

Fig. 5.—Method of rotating teeth (1877).

ted over the tooth, with the handle used as a lever; but this device lacked firmness of attachment,—a defect that is fully overcome by my plan.

"Fig. 5 represents one of the forms of these devices, and the ordinary methods of their application to the teeth.

"The apparatus should be made of eighteen-carat gold, unless it be the screw, which is often more durable if made of brass."

Under *Regulation of Teeth Made Easy* in the *Dental Cosmos,* 1878, page 18, we find the following:—

"My object is to show the advantages of a system founded upon principles, and at the same time illustrate the typical forms of apparatus necessary to show that this hitherto most difficult branch of our business may be made not only easier, but more scientific, by what may be called a positive system of mechanism, conducted in harmony with physiological laws. This system may be successfully practiced by any patient dentist of ordinary ability, who clearly understands the laws of mechanics involved, and the laws governing physiological and pathological changes of animal tissues while under pres-

sure, in order that the line between the two conditions may not be overstepped. The pressure upon the tissues should be intermittent, and only carried so far in degree as to be within the area of physiological or healthy action, and not beyond and into that condition called pathological; by the careful avoidance of which any movement of the teeth may be made without producing inflammation, and with little or no pain."

"It is not claimed that the pursuance of any *one* system *under all circumstances* is a guarantee against difficulties, as these are liable under any system, and it may be necessary to resort to other methods to gain some points.

"An inventive mind will suggest various ways and means to accomplish this point, but the accompanying illustration (Fig. 6) will be sufficient to meet the difficulty in most cases.

"The clamp or box-wrench (Fig. 6) having been firmly secured to the tooth, according to explanations, and the side-draught apparatus applied, a

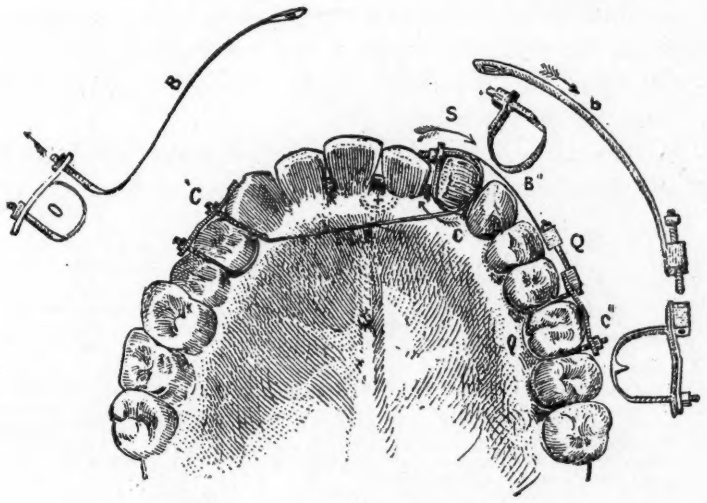

Fig. 6.—Appliance used in 1878.

counter-action is produced by securing a clamp, *C,"* around some distant tooth, *O* for anchorage; and having connected the two devices by means of a thin metallic (gold or platinum) band, *B,"* with one end first secured to the anchor-clamp around the distant tooth by means of a bolt, *Q,* through a smooth nut soldered to it, and the other punched end caught over a pin, *S,* soldered on the band of the clamp *C,* a corresponding offset force can be made by tightening the screw *Q,* which will cause the band to draw upon the box-wrench or band *C,* as illustrated in the diagram, which at the same time assists in the rotary motion of the tooth, care being taken always not to tighten this (as likewise with all regulating apparatus on the screw principle) more than will be comfortable to the patient. Just enough to feel comfortably snug, will, I have found, be about the right degree of pressure to be in accordance with the above law.

"Two of the greatest advantages recommending the positive system are firmness of the apparatus in the mouth, and the fact that, with a little instruction the patient is enabled, by the use of a properly made key for turning the

nuts (night and morning), to do a large part of the regulating work at home; thus rendering it unnecessary to go to the dentist oftener than once or twice per week, and sometimes not oftener than once in a week or two.

"Page 80. There are three principal forms of irregularity,—those without the esthetic line of the arch, those within this line, and the mixed forms, covering both the former. Leaving the two latter for future consideration, we will confine ourselves in this paper to the first. The third class, or the mixed variety, is the most difficult of regulation; the other two, though generally requiring about the same time, are more easily managed; and, though the apparatus may require considerable skill, the working of it is exceedingly simple.

"The entire practice of regulating teeth may be summed up under the following aphorisms or fundamental rules for constructing and operating mechanical appliances for such regulation, and which, it seems to me, will be self-evident to those who understand the philosophy of the positive system in theory and practice:

"1st. All mechanical appliances for regulating teeth should, if possible, be constructed upon the principle of the screw or inclined plane.

"2d. All apparatus for regulating teeth should be constructed with the view of being worn inside the mouth.

"3d. All mechanical appliances should be so constructed as to cause as little pain and inconvenience to the patient in speech and eating as possible.

Fig. 6-*A*.—Represents a simple little rotating apparatus that sometimes may be made of great service. The nut *T*, when tightened, draws the nut through the bar *U*, and being attached to the band-clamp *V* on the opposite side of the tooth causes the tooth to rotate, and at the same time drag backwards if desired. Should, however, this latter movement be undesirable, it may be prevented by a little screw, *W*, passing through a threaded hole in the bar *U*, which, impinging against some point (or nut) as shown, holds the tooth in position (1878).

"4th. All apparatus should be constructed as minute and as delicately as possible, and be capable of doing its work with certainty and effect.

"5th. All appliances should be so constructed as to relieve the patient as much as possible of the necessity of going to the dentist to have it adjusted; in other words, so that the patient can, with a little instruction, do most of the work, by means of keys to turn the screws and nuts.

"6th. Forces for the movement of the teeth should be applied once in about twelve hours, and as powerfully as possible, short of causing pain,—a point which may be best determined by the patient.

"I take an impression of the jaw and teeth (generally in wax), and having made a cast, sketch it upon paper, and, with the cast and patient before me, and a knowledge of the median line and lateral sway (if any), I indicate by arrows on the diagram, the line of direction in which the tooth should be moved, which serves as a guide in the construction of the regulating mechanism; after which the apparatus is made up.

"Having determined upon one or more posterior teeth (molars or bicuspids) on each side of the jaw to be used as anchorages, a band clamp (Fig.

7) (*A*) made of very thin (like paper) gold or platinum, about one-tenth of an inch wide, is constructed to fit around them firmly, by means of a bolt (*B*), passing through nuts *C*, *C'* (one plain and the other threaded), which are soldered, one to each end of the band (*A*), as represented in the cut. To prevent these clamps from working down and impinging upon the gums, they should be cut from plate wide enough to make one or two ears (*D*) in suitable places, which, when bent over and into the convolutions of the grinding surface, act as stays to prevent undesirable movement. Should the teeth be short, the bands may be made to hold firmly to the teeth by soldering on the inside clamp a small pinlike point, *X*, which will fit a small hole drilled into the tooth.

"Connected with these anchor-clamps by means of a little hook and ring (not shown in the diagram) or by solder, is a slim swaged platinum U-shaped plate, about one-quarter to one-half of an inch wide, which extends forward along the inner wall of the dental arch to within about half an inch of the

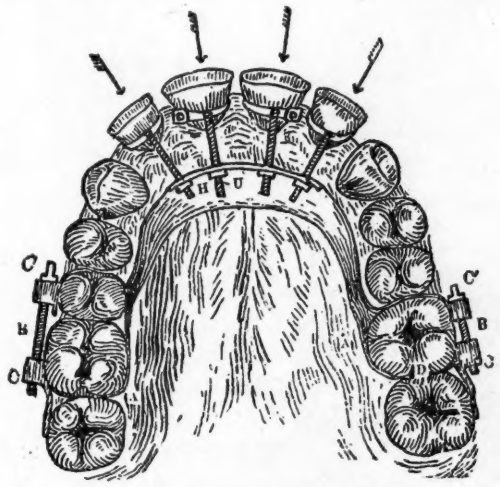

Fig. 7.—Method of retracting anterior teeth (1878).

protruding teeth, and which lies flat and snug to the gum and roof of the mouth.

"On the front margin, and in line of the forces to be given, are punctured ears (*H*), bent at right angles with the plate, or as many smooth-bored nuts (not shown in the cut) as there are teeth to be moved, through each of which passes a small bolt (*E*), having on the threaded end a nut (*F*). On the dental extremity of these bolts or screws are soldered loosely, in the eye of each a small ring (not shown in the cut), each of which bolt-rings is connected by solder or hook to little metallic clamp-bands secured firmly around their respective teeth. Sometimes, when it is found that the bulk of the rings or screws would require that the lower incisors be cut away too much in order to prevent contact, it is an excellent plan to solder a small piece of thin (clamp) plate between the clamp and the screw, which will take up but little room, and will be as pliable as any ring-joint.

"When the teeth are fully regulated they should be retained in position for at least a year, perhaps longer. This may be done by a delicate apparatus made

of narrow bands and strips of gold around the teeth, and secured to a delicate rim of plate work or plate wire connected with the bicuspids; or they may sometimes be retained by wearing a simple suction plate, having gold fingers passing between the teeth and bent nearly at right angles in front. Whatever the apparatus be, it should be kept clean and free from collections of food."

Page 307: "In the February number of the *Dental Cosmos* was explained one form of apparatus for regulating protruded upper front teeth separately."

"Fig. 8 illustrates a different modification of the apparatus for accomplishing the same object collectively. The apparatus is made to draw upon the outstanding teeth by the tightening of the nuts (*a*) similar to that device

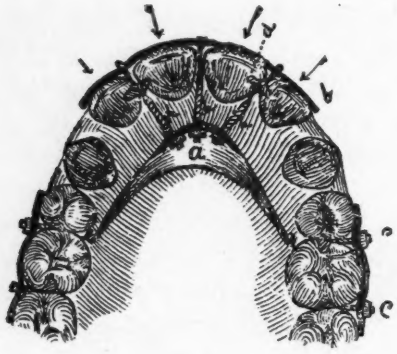

Fig. 8.

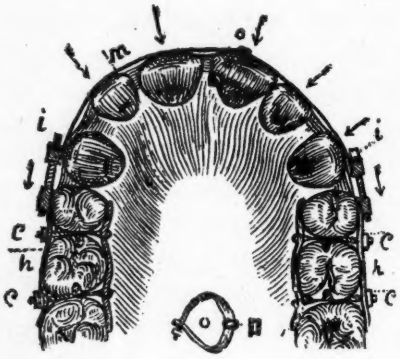

Fig. 9.

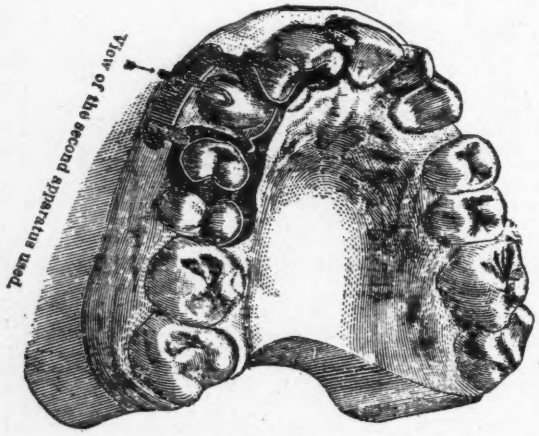

Fig. 9-A.—Elevating a cuspid (1878).

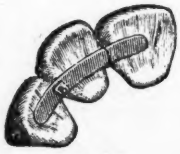

Fig. 9-B.—Retaining apparatus in position (1878).

explained in Fig. 7, but differs from it in construction in applying the forces to the teeth by a bar or plate (*b*) extending across all of the teeth to be moved.

"In all the accompanying figures, the arrows indicate the direction of the movement of the teeth operated upon.

"Fig. 9 illustrates another form of apparatus which acts upon the teeth collectively, also by means of a band (*m*) extending along the outer surfaces, and which is made to force against the teeth to be moved by tightening of bolts which pass through smooth-bored nuts (*i, i*) soldered to the ends of the band (*m*), and which enter threaded nuts soldered to anchor-bands (*h, c*) secured around the back teeth as shown. The bar *b* of Fig. 8 and band *m* of Fig. 9

should be prevented from impinging on the front gum by passing through the eye of a clamp-band *o*, secured to a front tooth, or, better still, by having a *T* soldered to the inside, so that the top of the *T* shall rest on the lingual surfaces of the central incisors."

Page 74, *Dental Cosmos,* 1879, "*Bands.*—All fixtures of this sort should be as delicate as possible, consistent with the necessary strength. The general tendency is to make apparatus too clumsy. On delicacy and accuracy of fit everything depends. One of the most important points to hold in mind is proper thickness of material. While the anchor-bars (not bands) may be of considerable thickness, those straps which reach from the anchorage to the teeth to be moved should generally be thinner, especially those portions which are intended to slip around the teeth when tightened by the bolts. A disregard of this point may lead to failure.

"The thickness of bars for molar teeth to which anchor-bands are secured (Fig. 10) should be about Nos. 22 or 23; for bicuspid teeth about No. 34 or 35, and in breadth not greater than is absolutely necessary for strength and firmness, say from 2/32 to 4/32 of an inch."

Page 607. "We will pass on to consider another plan of accomplishing the same purpose, which, although also old in principle, is worthy of mention,—the use of pieces of plate bent from time to time, so as to maintain sufficient temporary force against the teeth. (I do not include that class of appliances which are so constructed as to maintain continued pressure.) This

Fig. 10.—Anchor band (1879).

plan is practical with variously constructed fixtures, from a size less than that of the smallest tooth to that of the roof of the mouth; but, as a rule, small fixtures of this variety give the best results. First, for instance, a small piece of thick plate, an eighth of an inch or more wide, and half an inch or more in length, bent somewhat into the form of the letter U, can be made by being opened more and more, from day to day, to spread teeth sufficiently apart to insert an artificial one. By the use of longer bars or narrow plate, constructed on the same principle, extending across the mouth, secured to teeth in pits or by binders for anchorage, they may be made to successfully move teeth into line which have erupted in the posterior position on the opposite side of the mouth.

"Irregular and protruding front teeth may be drawn into position by the same plan, by occasionally bending metallic fingers extending from a plate secured inside of the mouth, and passing between or over the cutting edges of the teeth. This variety of fixture, although old and well known, is a favorite with many dentists.

"Besides the lateral movement of teeth, rotation may be accomplished to a certain degree, in some cases, by occasional bending of these metallic fingers.

"It may be thought that a nut facing towards the back of the mouth, as

suggested in some of my previous illustrations (Fig. 7) may be difficult to manage; but it is as easily operated as in any other case by properly made keys. While most of my fixtures are worked by the straight and curved 'box-keys,' flat, open wrenches, or by pointed levers, which fit into holes, I have a right angle key (Fig. 11) made to work on bevel-gearing similar to that used for right angle drill attachments to the dental engine; which enables a patient to operate the screws and nuts of any fixture, in any part of the mouth, as easily as he could wind his watch."

Page 302, 1881. *"Reasons of Success and Failure of Mechanisms Depending upon Unaided Impingement, Arising from Position and Shape of Teeth.*

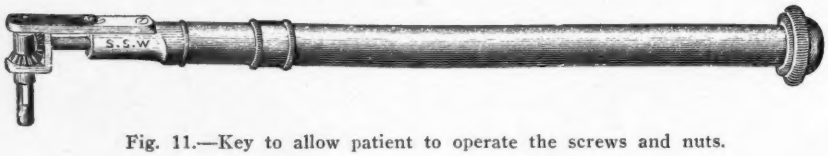

Fig. 11.—Key to allow patient to operate the screws and nuts.

"There are two means of retaining regulating devices in position: By impingement against the teeth, perhaps more or less assisted by the unevenness of their surfaces. 2d. By binding with strings, wire, or perhaps by lodgment on surplus plugs in cavities.

"First Proposition. In order to obtain scientific accuracy in regulating teeth by impingement, the direction of applied forces should be made on the plane of the shortest line, between the opposite points of impingement, by the mechanism across the jaw.

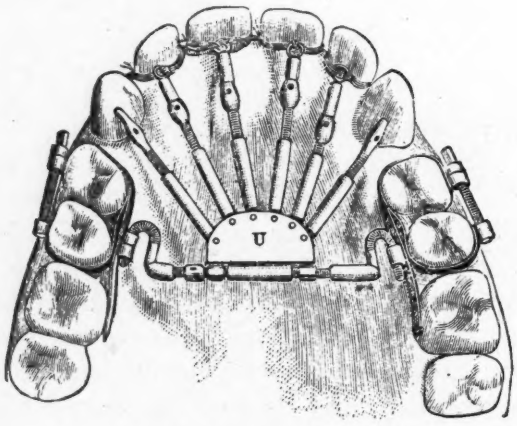

Fig. 12.—Enlargement of the arch (1882).

"Second Proposition. Position and shape of teeth govern the applicability of the principles of the first proposition.".

Page 76, 1882. *"Enlargement of the Arch.* A different device, made of gold, which could be bound to the teeth so that it could not slip off was used. It consisted of a system of jack-screws capable when used entire of acting upon twelve teeth at the same time, as shown in Fig. 12.

"In this case, however, only a part of it was applied at first, the remaining portion being added at a later period in the operation. The portion used con-

sisted of a double yoke jack-screw, with a bar extending against the first molars, which was firmly bound to the bicuspids by means of screws and nuts.

"The use of this portion of the apparatus was to force still further outward these six side teeth—four bicuspids and two first molars. During the latter portion of the time that this fixture was being used separately, a cylindrical spindle jack-screw was placed across the mouth, the points of which were set in little artificial pits, made in the lingual surfaces of the cuspids, for the purpose of forcing them directly outward before being carried forward.

"When it was convenient for the patient to visit me the retaining plate was removed, and the yoke jack-screw, which as before said was a portion of a larger apparatus was reinserted in its former place, not only to hold the four bicuspids and first two molars in position, but to serve as foundation to support the other portion of the compound system of jackscrews above alluded to, for the purpose of forcing outwardly the six front teeth. This portion consisted of six spindle-pointed jackscrews attached by rivets or sockets to a body, *U*, as shown in Fig. 12, which was fixed to the larger and more powerful yoke jackscrew on the side teeth. These six screws radiated from the body, *U*, like the sticks of a spread fan. The radiating principle used in the fan portion of this machine, which for a long time I supposed was entirely original with me, I am happy to acknowledge I subsequently learned from Garretson's *Oral Surgery* had previously been used in a somewhat similar way, though I think in a rather primitive degree of development, by Dr. A. Westcott. With this apparatus resting upon the firm yoke jack-screw in the rear, and the points of the spindle jackscrews firmly set in gold sockets tied to the four front teeth, as illustrated, these teeth in exactly one month were carired into the desired positions."

Page 186, 1882. *"Straggling Teeth.—Lateral Movement of Roots and 'Righting-Up' of Crowns:*

"The secret of the lateral movement of roots lies in firmly fixing the articulating ends of the crowns of the teeth to be acted upon while force is being maintained at their necks.

"There are two reasons for attempting a change in the condition of straggling teeth; the first is for the purpose of making room for others that are in process of development; the other is purely a matter of esthetics.

"A knowledge of the position of the apices of the roots of teeth is one of the first requisites to a clear comprehension in all cases, in order to proper treatment; for upon this depends the question of the highest esthetic possibilities. This vital point is often overlooked by young operators, and sometimes by older ones.

"As is well known, the direction of motion and degree of power necessary in mechanical leverage depend not only upon the length of the lever but upon the position of the fulcrum and the distance between it and the points of power and resistance. In the simple movement of the crowns of teeth the apical extremities of the roots of which are already in their proper position, the operation is always based upon that law of mechanics which places the fulcrum between the points where the power is applied and that of the resistance. (See Z, Fig. 14.) But, on the contrary, in an operation for the lateral

movement of roots of teeth the power should be placed between the fulcrum and the point of resistance. (See Z, Fig. 15.)

"Fig. 13 illustrates the front portion of the upper jaw in this and similar cases as they appeared when the apparatus was first applied, and also beautifully shows how it is sometimes possible that the same power from the same device, when continued to be used at the same points throughout the entire operation can be made to act very differently upon different portions of the teeth and sockets at different stages of the operation, by an automatic shifting of the place of the fulcrum so that the direction of the force by the leverage becomes reversed.

"In the treatment of such cases (Fig. 13) where the roots as well as the crowns are out of their proper position, it may become necessary at different stages to adopt the principles of both rules of leverage philosophy. To make the matter plain let us refer to four ideal figures, 14, 15, 16, 17, which diagrammatically illustrate four successive stages in such treatment. Let *B* represent the alveolar process; *R, R,* central incisors (straggled); *P,* gold clamp-bands operated with a screw; *F, F,* fulcrum, or places of the fulcral bearings; *C, C, X, X,* places where the teeth have separated from the socket-walls, the arrows indicating the direction of the movement of the different portions of

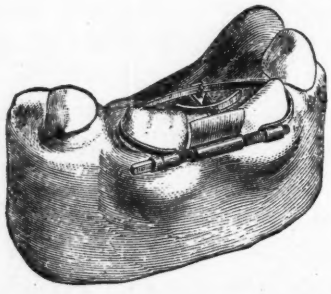

Fig. 13.—Appliance used for lateral movement of roots and "righting-up" of crowns.

the teeth at different stages in the operation that caused the 'spaces,' and we shall soon see how simple it all is. Now, if the septum, *B* (Fig. 13), which acts in a measure as a fulcrum, be hard and unyielding, and the alveolus about the apices of the roots be soft, the force of the clamp-band about the necks, as shown, would cause the apices of the roots, *R, R* (if fully formed and calcified), to move in the direction of *S, S,* causing separations from the socket-walls at the opposite sides, *A, A.*

"It should, however, be remembered that, in actual practice, instead of the septum being a positively unyielding substance, it undergoes more or less absorption, and possibly some condensation, especially if the applied force should be greater than is required to cause absorption. The effect of this reduction of the fulcrum (septum) under the pressure of the dental lever is to reduce materially the degree of inclination of the crowns referred to. The real attitude of the teeth, after such alveolar changes, is approximately shown by Fig. 15.

"Under such circumstances any force applied to the crowns of the teeth that would be sufficient to draw them in contact at the point O (Fig. 15) would cause separations between the necks of the teeth and socket-walls at the points

C, C, on one side and the opposite movement of the apical portions of the roots (if calcified) would, through this play of the different arms of the lever, cause other separations on the opposite sides of the sockets at *X, X;* both of which 'spaces' would increase, as the case would advance, until the crowns were brought in contact, as shown.

"The first stage in the operation is now completed, and the time for the next has arrived. The object of this second stage is to produce approximate parallelism of the teeth, by causing the apical portions of the roots to approach each other. At this point the curious change, before referred to, takes place in the play between cause and effect, for, by the same power from the same apparatus, the forces act upon the apices of the roots to cause them to return

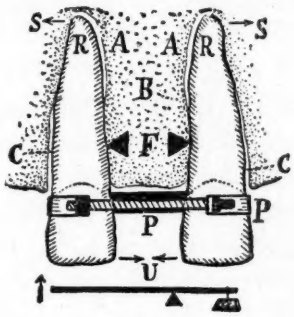

Fig. 14.

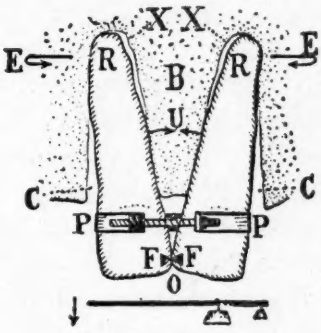

Fig. 15.

Figs. 14 and 15.—First stage of the operation.

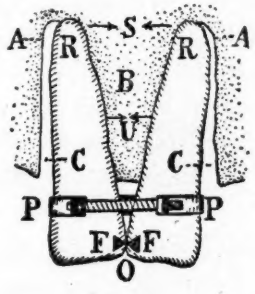

Fig. 16.

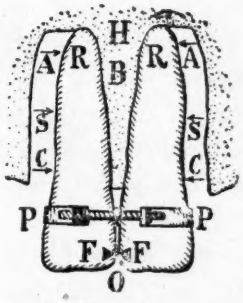

Fig. 17.

Figs. 16 and 17.—Second stage of the operation.

and travel in exactly the opposite direction. (See *E, E,* Fig. 15 and *A, A,* Fig. 16.)

"This change in the direction of movement of the apical extremities of the roots is brought about from the fact that the moment the crowns are brought in contact at the point O,—at that same moment, if the power of the clamp-band be continued, the fulcrum automatically shifts from the position about *B* in the septum to the point of contact of the crowns at *O.* This shifting of the fulcrum changes materially the philosophy of the leverage, by placing the power between the fulcrum and the point of resistance, instead of outside of it. (See *Z, Z,* Figs. 14, 15.)

"Fig. 16 illustrates the relative changes in position between the teeth and

sockets at a little later period in the operation, and Fig. 17 the appearance at its close. The spaces formed by separation of the teeth from their sockets fill in with new, but soft tissue formations as fast as the teeth move. The yielding nature of this new deposit of tissue is the reason why regulated teeth are loose for a considerable length of time afterward, and suggests the reason why they should be kept steady until sufficient time shall have elapsed for calcification. The mechanism which I use in such an operation, as shown by Fig. 13, is made up of two parts; a clamp band, to draw the teeth together, and a lock portion, to hold stationary the cutting edges of the teeth; but while the crowns of the teeth are being drawn together, only the band portion need be used."

Before the First District Dental Society, New York, *Dental Cosmos,* page 153, 1886, Farrar discussed among various orthodontic problems, the question of *Shortening the Dental Arch* and showed many devices to accomplish his purpose, saying,

Page 159: "In constructing devices for regulating teeth, especially for large operations, five points should be considered: First, simplicity; second, practicability; third, painlessness; fourth, convenience; fifth, cleanliness. That which is practicable, so far as the mechanism is concerned, may be extremely inconvenient, if not painful. For various operations, including this, Magitot mentions in his work the use of hard rubber plates, with wooden pegs set in holes. The plate is formed so as to extend outside of the front teeth, through which at different points are daily driven more and more the wooden pegs, which impinge against and move the teeth. In place of these wooden pegs Dr. Gaines, of England, has used screws."

Page 162: "I now have much better and more convenient forms made as follows:—To each anchor clamp-band there is soldered on the lingual side a smooth staple or a hook to fix other parts to. Through or to these anchors are fixed the legs of a small U-shaped wire, threaded about one inch from the ends. This wire is bent to lie close to the gum alongside the lingual walls of the bicuspids. There are various other ways this might be attained, but they are objectionable.

"When this apparatus is ready for use and the anchor clamp-bands are in position, the teeth to be moved may be attached by a front bar, or better, by a small individual band, placed around each tooth, and connected independently with the front part of the *U* drag-wire by a string or wire. They may also be connected by small flat-rolled wire, by hook, ferrule or solder. The legs of the *U* wire are passed through the smooth anchor staples and held in place by hooded nuts, as shown here, or by ferrules."

Page 165: *"Outside Apparatus for Drawing in Protruding Teeth.*—The outside apparatus for drawing in front teeth consists of two clamp-bands for anchorages fitted around the posterior teeth, to which is attached, by a screw, a long band extending from one anchorage-band around the front of the arch to the opposite anchor-band."

Page 405: *"Caution to Be Observed in Correcting Protruding Front Teeth.*—The correction of deformity caused by abnormal protrusion of the six upper front teeth, however, requires a greater degree of anchorage than the posterior teeth afford, thus requiring great judgment and care; for, as the con-

dition of the alveolar process varies at different ages and in different people of the same age, it necessarily follows that the value of posterior teeth as anchorage must also vary. In other words, the anchorage resistance of teeth has a limit inside of which oral apparatus may be used with great success; outside of which, caution, at least is necessary. This limit, however, depends somewhat upon the point of attachment of the apparatus; for, when the draught is made from the necks of the teeth, the degree of anchorage resistance is greater than when from near the grinding surfaces; as in the latter position the crown acts as a lever upon the socket tissues.

"Fig. 18 is an outside view of Farrar's bridle apparatus for correcting deformities caused by protruding front teeth.

"According to my experience the degree of anchorage resistance of bicuspids and molars may be approximately stated as follows:

"Relative Anchorage Resistance of Teeth.

"1st. The anchorage resistance of two bicuspids is sufficient to move one cuspid; but as the resistance of both is nearly equal, they are equally affected,

Fig. 18.—Head gear as used by Farrar in 1886.

and in approaching each other by means of a clamp-band will meet about half way.

"2d. The anchorage resistance of one molar is sufficient to move the first bicuspid into the place of a missing second bicuspid.

"3d. The anchorage resistance of one bicuspid and one molar is sufficient to move one cuspid and one lateral incisor.

4th. Assuming that the first bicuspid is extracted to make room, the anchorage resistance of the second bicuspid and two molars (fully developed) is generally sufficient to move the cuspid back against the second bicuspid, and is sufficient afterward to draw back the contiguous incisor and one central about one-eighth of an inch, sometimes more; but this can not be relied upon.

"By the above it will be seen that, in order to correct the deformities under consideration by means of inside apparatus, the operation should not be commenced until the patient is about the age of twelve or thirteen years; for

at an earlier age the anchorage resistance is liable to be insufficient, and these posterior teeth will be liable to move forward and meet the front teeth moving in the opposite direction before they have reached the desired position, thus rendering the completion of the operation with apparatus depending solely upon bicuspids and molars for anchorage difficult if not impossible.

"Should the anchor teeth, through carelessness, or lack of experience, be tilted or moved forward too much, the further use of such teeth for anchorage should be postponed for several months, perhaps a year, when they will generally become sufficiently reset to complete the operation, if conducted with care. Instead of postponement, I prefer, however, to make such cases exceptions to the rule and push the operation on to completion by the aid of the same apparatus modified, making the back of the head the place of anchorage, and using the portion on the posterior teeth as a retaining fixture only, as illustrated by Fig. 18.

"By this apparatus (which I shall presently explain) the advancement so far made by the teeth may be retained, as the case progresses, by taking up

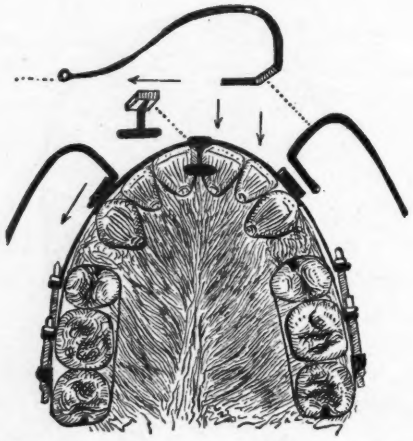

Fig. 19.—Inside view of Farrar's "Bridle apparatus" (1886).

the slack in the inside apparatus from day to day, thus insuring the case against accidents such as would occur should the outside portion of the apparatus slip off or get out of order. This combination also permits the safe removal of the outside portion and the temporary suspension of the operation during school hours.

"Bridle Apparatus for Correcting Protruding Front Teeth.—P. 409: The details of construction of this apparatus are as follows: A gold strap made of rolled wire, having a smooth nut on each end, is bent to conform with the anterior surfaces of the four or six front teeth, and fastened by means of screws to clamp-bands on the posterior teeth, as shown in Fig. 19. To prevent this front band from slipping upward to the gum, troughs have been tried, but they collect food and injure the teeth. I use one or more *T* pieces, made to fit between the teeth, soldered to the band or to ferrules sliding on the band, as used on some of my similar band apparatus of ten years ago (see Fig. 19), or broad plate hooks. Another plan of attaining this end is by the use of a round wire resting upon the lingual surfaces of the teeth, connected in the same way to the

front band. The nearer the cutting edges of the teeth these front wires rest, the less power it requires to move the teeth.

"The front band is connected with the outside apparatus by means of cylindrical or angular ferrules or staples soldered to it at points opposite the space between the laterals and cuspids. Through these ferrules or staples, which are at a sufficient distance from the corners of the mouth to prevent drooling, are hooked bent cheek-wires, *C, C, C,* (about No. 12), which project forward and outward, thence pointing toward the ears on a line with the front band (Fig. 19). To prevent the falling over of this curved cheek-wire one side of the ferrule portion may be filed flat, and the ferrule shaped to correspond by a blow of the hammer; but this is seldom necessary.

"When the apparatus is in position the friends of the patient are instructed to tighten the posterior bands or to turn the nuts within the smaller rings daily. The patient is advised to call at the office once or twice per week, when, if the position of the teeth has changed sufficiently to render the front band liable to slip off, the direction of the draught should be changed by raising the nut-ring from a lower hook on the ear-ring to one higher.

"Since devising this apparatus I have been able to regulate protruding front teeth in all cases, before as well as after the development of the second molar; and if it is made properly and delicately it operates easily, accurately, and is neither uncomfortable nor very unsightly.

"This apparatus resembles somewhat a fixture described by Dr. Kingsley, but differs widely in the object, philosophy of construction, and the character of force. The latter has for its object to depress protruding teeth in their sockets; the former to move teeth posteriorly. One is constructed with a leather skull cap and elastics for continued force on a line from the cutting edges of the front teeth to the crown of the head, or nearly in line of the long axis of the teeth; the other is a skeleton bridle constructed of woven inelastic material, connected with the teeth by means of screws, for the purpose of intermittent pressure on a line at right angles with the long axis of the front teeth, directed towards the back portion of the head.

"My methods of retaining such teeth in their new position consists in fastening gold wire into cavities in the bicuspids and molars with amalgam, as shown. As amalgam hardens slowly, the wires should first be set with phosphate of zinc, replacing only one or two plugs with the amalgam at each subsequent sitting until all are changed."

Before the section of Dental and Oral Surgery, at the Ninth International Medical Congress in a discussion of the paper of E. H. Angle, after reviewing informally, at considerable length, the papers on *Etiology of the Teeth,* J. N. Farrar spoke concerning the reason for correcting irregularities of the teeth by intermittent force:

"To differentiate more clearly, I will reiterate in brief that, while the old plans of constructing regulating apparatus only recognized one thing as essential, force, a view based upon the belief that 'force is force,' no matter of what character or as one essayist puts it, 'it matters little whether the pressure be continuous or intermittent, since the results are the same,'—implying that the

results are the same, and not even taking into account the almost necessary concomitant of such devices, filthiness,—I claim that the character of force can govern the question of pain, that the tissues will always painlessly tolerate a proper degree of intermittent force if not too frequently repeated, and that any cleanly mechanical apparatus which can be controlled at will so as to attain these ends, when based upon and operated with these functions in view, embodies the main principles of a system that I consider the most scientific.

"This being my opinion, it goes without saying that regulating apparatus constructed substantially as here shown by the essayist preceding me, must be, in the main, in accordance with my views; but when the essayist attempts to assert that this is a new system of regulation and retention, I think he is assuming that which can not be accepted by readers of the dental journals. So far as the mechanical devices are concerned, it would be easy to mention the journals which contain descriptions and illustrations, substantially, of every one of them. But this is not the time or place to do so; indeed, it is unnecessary, as they must already be familiar to all.

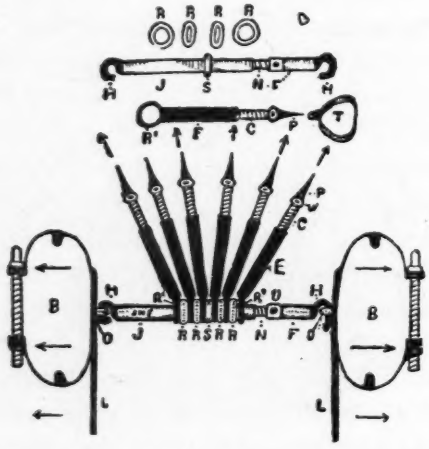

Fig. 20.—Machine for enlarging the upper dental arch (1887).

"Mechanisms for regulating teeth are now numbered by the hundred; some are simple, others complicated; both kinds are equally valuable in their place. Of the many fixtures that I have devised and published from time to time, probably the simplest is a metallic clamp-band made of a ribbon of rolled gold wire, on each end of which is soldered a nut, which in turn are connected by a screw.

"The clamp-bands as well as the splice-bands may be prevented from working down upon the gum by having ears made upon them to rest in the sulci of the teeth, or by gum guard-rings having lugs for the bands to rest on.

"Clamp-bands are excellent anchorages for jackscrews, which may be made to push or to draw teeth in nearly every direction. This combination may be simple or complex, depending upon the number of parts and pieces used.

"The more complicated fixtures in connection with the clamp-bands I generally improvise from various elementary devices selected from what I denominate the 'universal set.' This consists of different sizes of anchor-bands, push-

jacks, *E;* draw-jacks, anchor-jacks, *J;* rings, *R,* T's, *N;* ferrules, *T,* etc., samples of the most of which are represented in Fig. 20.

"To return to our case, the upper jaw received the principal share of the attention, the lower teeth being reduced only sufficient to better fit the needs of the upper arch when it should be properly enlarged. While the upper jaw was too small to be in proportion with the other parts of the face, the lower jaw was not, and only required slight alteration. The lower arch was somewhat crowded in the region of the cuspid teeth, which were inclined forward, lapping and partially hiding the front of the lateral incisors. The bicuspids also had not sufficiently erupted to be on a plane with the antagonizing surface of the others. To regulate the lower arch one of the bicuspids on each side was extracted, and the cuspids drawn back by means of gold clamp-bands extending around the molar teeth for anchorage; the bands being operated by screws and a key.

"The third and main step, the spreading of the upper arch, the most interesting portion of the operation in the case of this patient, was successfully ac-

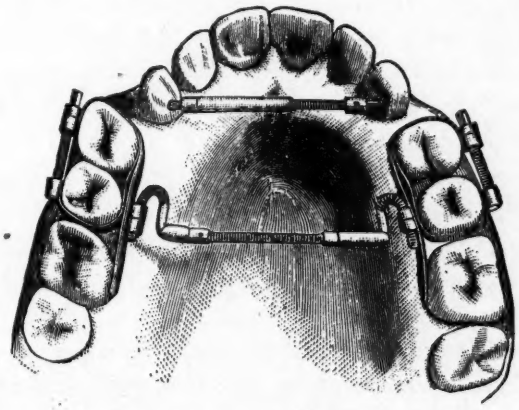

Fig. 21.—Appliance used by Farrar (1887) and described before the Ninth International Medical Congress.

complished in stages, intermitted by periods of rest. The first step of the operation upon the upper jaw was the partial outward movement of the bicuspids and the first molars. The apparatus consisted of a system of jack-screws capable, when used entire, of acting at the same time, as shown in Fig. 22.

"Only a part of the device, however, was applied at first; this consisted of a double-yoke jackscrew with a bar extending against the first molars, which was firmly bound to the bicuspids by means of screws and nuts as shown.

"The use of this portion of the apparatus was to force outwards these six side teeth. At this stage a cylindrical spindle screw-jack was placed across the arch for the purpose of forcing the cuspids directly outward before being carried forward.

"Fig. 21 represents the appearance of the upper jaw at this time, with the six side teeth nearly in position. These instruments had, in eleven weeks, carried the side teeth sufficiently outward to be directly over the lower arch. At this point the masticating functions of the teeth being perfect, these appliances were exchanged for a simple hard rubber plate, and the treatment suspended

for several months, for rest. The cuspids and four incisors required to be forced radially forward, over, and in advance of the under teeth.

"The retaining plate was finally removed and the jackscrew reinserted to hold the four bicuspids and two first molars in position, and to serve as a foundation to support the other portion of the compound system of jackscrews, for the purpose of forcing outward the six front teeth. Fig. 12 shows the appearance of the case at the completion of the operation and before the apparatus was removed."

In 1888 Farrar published the first volume of *A Treatise on the Irregularities of the Teeth and Their Correction* containing 757 pages and 695 illustrations. This volume was based upon the articles already reviewed and therefore will not be taken up in greater detail. Under Chapter XLVI and XLVII, pages 487-498, *Antagonism of the Teeth, Theoretical and Actual—Different Kinds of Occlusion,* the following will, no doubt, be of interest to the readers of this historical review:—

"The division of the dental arch into sections, constituting what are denominated teeth, together with the peridental pocket (cushion), in which each of them rests, allows greater elasticity of movement than would be the case if all the teeth were massed into one. This independence of action not only renders them less liable to wear away, but also enables them to move about by the antagonism of their inclined surfaces until they fit themselves to each other. If one section becomes disabled, so that it is necessary to extract it, the remainder are held comparatively undisturbed. The theory of this independent movement of the teeth in most cases is proven by the worn and highly polished facets that are plainly noticeable on the approximate surfaces of teeth in aboriginal skulls, which can be seen in museums.

"In the art of correcting irregularities, a perfect understanding of antagonism, and of the influence of lateral pressure of adjacent teeth, is still more important to insure the permanence of the new relations after correction; for it should be remembered that success in regulating teeth depends not only upon adjusting them so that they will have sufficient room to stand freely, but also upon holding them in place by the interlocking of some of the cusps. Indeed, without this knowledge, no one should expect permanent success in his operations. In some cases, it is even more difficult to fix the teeth so that they will remain in their new positions than it is to move them into line.

"There are, however, some aspects of this question that should be observed; for instance, if the line of continuity of the arch is broken by the loss of some of the teeth, and some of the remaining teeth antagonize obliquely, a greater or less number, adjacent to the gap, will probably move away from their neighbors along the open territory; or, if the obliquity is in the opposite direction, toward a portion of the mouth which is already overcrowded, not only may the deformity become more striking, but, at the points of contact, necrosis of the enamel may occur. In such cases, the enamel in time breaks down in decay. Thus it will be seen that the locking of teeth has its advantages as well as disadvantages."

"Perfection Not Attainable.—Perfect antagonism, such as is found in the highest order of human development, is a condition that can not be attained in

all cases, but must be regarded rather as a point to be aimed at and reached so far as practicable. An attempt to secure more would not only be found impracticable in many cases, but (if possible) it might also be at the sacrifice of esthetic results. To reiterate, although, theoretically, perfection of antagonism is desirable, it is in practice not only often impossible to attain, but in some cases it would also be injudicious to attempt it, as it might increase facial deformity.

"In cases where the upper alveolar ridge is too small to accommodate the teeth, which are consequently overcrowded and jumbled, while at the same time the jaw and upper part of the face correspond in size with the lower, it is evident that if we proceed to enlarge the upper arch sufficiently to accommodate all the teeth in line, we would not only destroy the antagonism, but would also cause, as has been implied, protrusion of the lips. To avoid this result, extraction of one or more teeth is the only alternative, in order to bring about the arrangement which best combines usefulness with improvement of the face. In some cases, antagonism should be regarded as second in importance. That is to say, the aim of the operator should be to reach the highest

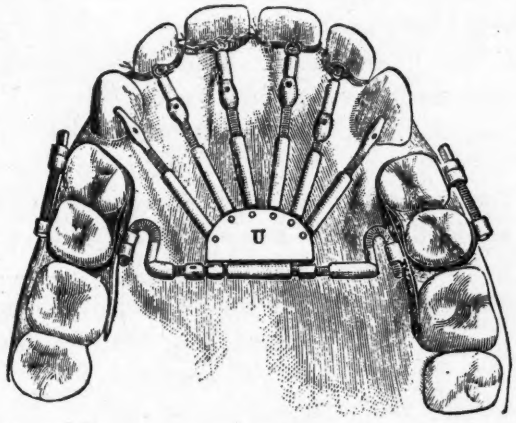

Fig. 22.—Appliance used by Farrar (1887) and described before the Ninth International Medical Congress.

possibilities, taking all things into consideration. To avoid deforming the face, while securing the best antagonism possible under the circumstances, is more desirable than to gain antagonism by the sacrifice of appearance. Let us try to increase usefulness by improving antagonism and mastication as far as possible, but let us not, in order to effect these, permit the faces of our patients to assume the appearance of apes."

In 1895 before the Odontological Society of New York, Farrar, in discussing a paper read by Calvin S. Case on the *Bodily Movement of Teeth,* published in the *Transactions of the Odontological Society,* page 69, replied:—

"This society should congratulate itself upon having such an interesting presentation of this subject as the essayist has given us this evening. Now, to his question, do we 'believe that the bones around about the roots of the teeth were bent?' I will say I think they were; but just how far they were bent, or just what and where all the parts were altered, of course can only be inferred from the outward appearances. If we could take the flesh off the bones before

the operation, and then take a cast of the bone, then return the flesh, regulate the teeth, and then take another cast, we could prove the facts; but at present we must be content with reasoning upon the subject. That the bones under the lower part of the nose can be bent by applying force to the incisors I have had proof of in some of my operations. Let me tell how I first caught upon the fact. Several years ago (1886 and 1887) I had occasion to regulate a case of protruding upper teeth for a young lady about fourteen years of age; the lower part of her lower lip was somewhat prominent but the upper part was not as full as it should have been. I drew the lateral incisors posteriorly (after having caused the cuspids to naturally move into the places of the extracted first bicuspids) by a gold skeleton mechanism anchored to the posterior teeth, and when these teeth were in their proper places (against the cuspids) the same mechanism was applied to the centrals; but the anchorage resistance was not sufficient to move them far without moving the posterior teeth forward, therefore I was obliged to resort to the skullcap or headgear, a sort of harness, having gold draught wires connecting it with the ends of the crowns of the incisors. By retightening this harness these teeth (crowns) moved posteriorly, in the same way as other dentists have noticed in their operations; but now comes the point intended by mentioning this case. One day the father called on me and said, 'Myself and wife have concluded to take our family to Europe; now, how soon can you push my daughter's case through?' He also told me when he would like to sail. I replied, 'It can only be hurried by increasing the force, and perhaps the case will not permit of great increase without causing too much pain; but I will immediately begin the trial.' The draught upon the teeth was increased gradually, and in a few days it was carried to a point that caused the head to ache slightly. Shifting lower a part of the anchorage so as to include the base of the occipital region, the full force was maintained. During all this time however, the patient said that she noticed no pain about the teeth, but incidentally remarked that there was a peculiar feeling just under the nose. This, however, made no impression on my mind, as I had often heard similar remarks from other patients under similar operations.

"We were now applying all the force that the harness would permit without causing headache, and the teeth were moving gradually,—but not as rapidly as the parents desired. To my surprise, however, the father and daughter called one evening about ten o'clock, and said, 'My daughter's teeth are now moved in far enough.' I examined the case, and sure enough the teeth had moved more rapidly than I ever knew teeth to move before, and had reached their proper places. But what had caused the sudden change seemed mysterious until I examined the contour of the entire lip and nose, and found that the same changes had taken place that Dr. Case's casts present. The upper part of the lip was now filled out, and the end of the nose was slightly advanced.

"It was plain to be seen that the drawing upon the ends of the crowns had thrown the roots forward, and that this was the cause of the outward changes in the lip and nose; but whether the suture between the halves of the upper jawbone had yielded and the borders of the bone turned outward, or whether sufficient decalcification had taken place in the bone to enable it to bend by the leverage of the teeth upon it, I could not determine; but one thing was certain,

great changes had taken place in its contour and the roots of the teeth had moved forward *en masse* by tilting on fulcrums at the necks.

"This was a lesson that led me to an idea of the possibilities of such operations, and I immediately determined to work upon this line with improved mechanisms. I now have some half dozen, all based upon philosophical laws. I have brought with me several engravings of these, taken from my forthcoming volume, which I will pass around after I have sketched them upon the blackboard, so as to explain their action. I wish to say, however, before I proceed, that I regard Dr. Case's mechanism not only simple but philosophical; that it is practicable he has proven by his results. Mine differs from his, and, therefore, the combination of his mechanism belongs to him.

"As you will finally see, the engine of force in all my mechanisms for moving roots forward is placed within the dental arch, represented by this sketch (Fig. 23) the base of support is a transpalatine screw-jack, anchored by two clamp-bands, that embraces the side teeth; from this jack to the pos-

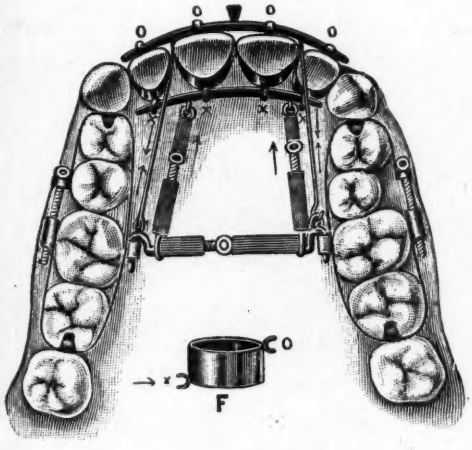

Fig. 23.—Mechanism for moving the roots forward en masse (1895).

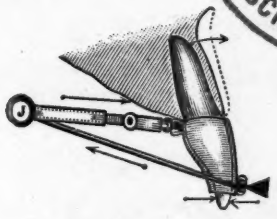

Fig. 24.—Showing the principle of applying compensating force (1895).

terior sides of the neck of the incisors, and lying close to the sides of the arch, are two other screw-jacks to press against these front teeth; to hold these jacks upon them, each incisor has upon it a broad ferrule (cemented), with a U-shape lug on the lingual side, near the gum (see *F* in lower part of Fig. 23), in which a bar connecting the anterior ends of the jacks rests. To hold firmly the ends of the crowns of the incisors, and prevent them from moving forward when these jacks are set at work against the necks of the teeth they (the ends) are tied to the transpalatine jack by two wire cords, connecting with a cross-bar lodged in other U-shape lugs soldered to the labial side of the ferrules, near the ends of the teeth, as represented by this sketch. (Fig. 24.)

"In another mechanism I use more radial screw-jacks than in this one, for forcing the roots forward; these are arranged thus (see Fig. 20). The ends of the crowns are held fixed by a wire bow placed in U-lugs, one being hooked into a wire ring soldered to the lingual side of the anchor-bands, and

the other screwed to the corresponding side of the other band. It is a modification of my screw long band.

"As will be seen, all these mechanisms are for moving forward the roots of the front teeth where the upper part of the upper lip is sunken; but for moving the roots posteriorly, as needed in cases where the upper part of the lip is too prominent, they would not be practicable without some modifications being made in them; these modifications can be made easily. This mechanism, like all the others that I have described, acts compensatingly, one force upon the anchorage being balanced by the others.

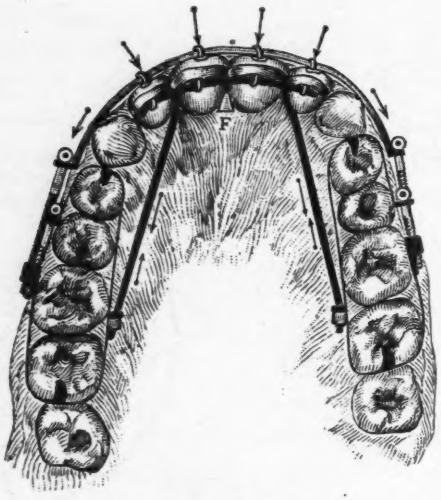

Fig. 25.—Mechanism for moving posteriorly the roots of upper incisors (1895).

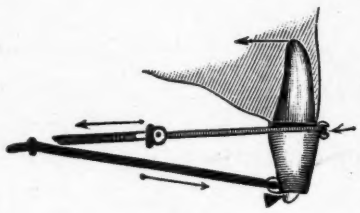

Fig. 26.—Showing the philosophy of the use of the brace and long band (1895).

Fig. 28.—Metallic slip noose rotating fixture.

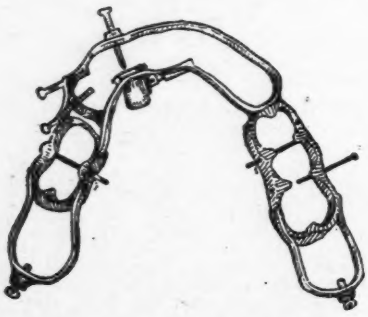

Fig. 27.—Appliance found in Farrar's Vol. II. (1877).

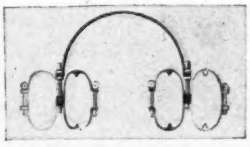

Fig. 29.—Adjustable clamp bands and arch as described by Farrar (1879).

"The above sketch (Fig. 25) represents a mechanism designed for this purpose, and it is very similar to several that I published many years ago. The crowns are stayed by an inside rectangular frame resting in U-shaped lugs at the ends of the crowns, and braced against nuts soldered to two anchor-clamp bands on the side teeth; the roots are drawn back by what I call a screw-acting long band resting across the labial sides of the necks of the teeth to be acted upon and attached to the clamp bands by screws." (Fig. 26.)

In 1897 Farrar brought out his second volume of *Treatise of Irregularities*

and Their Correction, a volume as large as his first one. Among the appliances devised by him is the one shown in Fig. 27 and represents "an elaborate gold mechanism, devised mainly for moving the cuspid a short distance away from the central and lateral, and not for any other part of the operation. It consists of anchors, a hinged wing-piece, three screws, three pins, and a small screw-jack. The anchors consisted of two ferrules and two thumbscrews. To the anterior parts of the anchors were soldered two rigid bows, a lingual and a labial.

"To the posterior parts of the ferrules were soldered two rigid wire loops. These extended posteriorly and embraced the molars. The thumbscrews were for tightening the rear parts of the loops upon these molars. The two screws on the patient's right were for moving the lateral toward the right central.

"In order to make this screw bear sufficiently high upon the wing and under the lip of the gum, it was necessary to project it (the screw) through a place in the gum (made by a lance) between the central and lateral. To prevent the screw from irritating this gum-tissue, the threads on the wing extremity of it were filed away, leaving it smooth for about one-eighth of an inch from the end."

The International Journal of Orthodontia

PUBLISHED THE FIFTEENTH OF EVERY MONTH BY

THE C. V. MOSBY CO., 801-807 Metropolitan Bldg., St. Louis, Mo.

Foreign Depots—*Great Britain*—Henry Kimpton, 263 High Holborn, London, W. C.; *Australasia*—Stirling & Co., 317 Collins Street, Modern Chambers, Melbourne; *India*—"Practical Medicine," Egerton Street, Delhi; *Porto Rico*—Pedro C. Timothee, Rafael Cordero 68, San Juan, P. R.

Subscription Rates—Single Copies, 30 cents. To anywhere in United States, Cuba, Porto Rico, Canal Zone, Mexico, Hawaii and Philippine Islands, $3.00 per year in advance. Under foreign postage, $3.40. English price: 15/ per annum, 1/6 per number. Volume begins with January and ends with December of each year.

Remittances—Remittances for subscriptions should be made by check, draft, postoffice or express money order, or registered letter payable to the publishers, The C. V. Mosby Company.

Contributions—The editor will be pleased to consider the publication of original communications of merit on orthodontic and allied subjects, which must be contributed solely to this journal.

Opinions—Neither the editor nor the publisher hold themselves responsible for the opinions of contributors, nor are they responsible for other than editorial statements.

Reprints—Since it is not desirable to hold type standing longer than absolutely necessary, all requests for reprints should be made at time of submitting manuscript for publication. Rate card will be sent with galley proof.

Communications—Contributed articles, illustrations, letters, books for review, and all other matter pertaining to the editorial department should be addressed to the Editor, Doctor Martin Dewey, 25 East Washington Street, Chicago, Ill. All communications in regard to advertising, subscriptions, change of address, etc., should be addressed to the publishers, The C. V. Mosby Company, 801-807 Metropolitan Building, St. Louis, Mo.

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Entered at the Post Office at St. Louis, Mo., as Second-Class Matter.

EDITORIALS

The Weakness of the Gingival Margin

WHEN we stop to consider the almost universal prevalence of gingival infection among people of middle age, we are forced to stop and wonder why this condition is so common. The principal reason for infection of the gingival tissue lies in the fact that we have a condition existing around the gingival margin of the tooth that does not exist anywhere else in the body. In the formation and development of the tooth, Nature was forced to permit a weakness from the standpoint of construction, which she was able to prevent everywhere else. The weakness of the gingival tissue exists in the fact that there is a break in the epithelial covering of the oral cavity at the gingival margin of the tooth; hence, as a result of this break in the epithelial covering, the connective tissue is exposed to infection in a manner not found in

any other part of the body. During the process of development of the enamel which is a structure derived from epithelium, we find the enamel finally becomes completely calcified in such a manner that the remaining epithelial tissue can not become physiologically attached to the enamel. Consequently a break in the epithelial tissue between the enamel of the tooth and the epithelial lining of the mouth occurs at the gingival margin.

Nature has attempted to remedy this defect by shaping the gingival marginal ridge of the crown of the tooth and by developing the fibers of the peridental membrane, which hold the soft tissue, supporting the epithelial lining of the oral cavity, up against the gingival marginal ridge of the tooth, in such a manner as to mechanically prevent infection or prevent anything from crowding in between the enamel of the tooth and the epithelial lining of the mouth. When we stop to consider the normal disadvantage which Nature is working against in this region, we must admit that the result is highly satisfactory considering the difficulties she has to encounter. In normally shaped teeth, with normal gingival marginal ridges, and teeth properly placed with normal proximal contact points, we find that the peridental membrane, supporting the soft tissue, holds the epithelial lining up around the enamel of the tooth, in such a manner as to make a very effective stoppage between the epithelial tissue and the enamel and thereby prevent infection of the underlying connective tissue.

However, if as a result of malocclusion, the gingival marginal ridge of a tooth and the proximal contact points are not properly placed, this mechanical stoppage between the gingival marginal ridge and the epithelial lining of the mouth is faulty, and infection of the underlying connective tissue is more liable to occur. It must also be remembered that any mechanical device which interferes with the epithelial tissue and its contact with the gingival margin of the tooth is going to expose the connective tissue to infection. The weakness of the gingival margin of the tooth must be recognized and everything must be done to assist in giving the same protection that has been given other parts of the body.

Permanent Staff Appointments for the Forsyth Dental Infirmary for Children

A COMPETITIVE examination of graduates in dentistry (of less than three years standing) for appointments to positions on the permanent staff for full and one-half time service will be held early in June at the Infirmary.

Appointments will be made for one or two years as follows:

Full time service requiring operating five and one-half days a week at a salary of $1000 a year.

One-half time service requiring operating six half-days a week, either forenoon or afternoon, at a salary of $400 a year.

These appointments will be made subject to satisfying the requirements of

the Massachusetts State Board of Registration in Dentistry and to "qualifying" in the practical work of the clinics during one month's trial.

Members of this staff will be entitled to the advantages of reports and clinics by experts in the various branches of dentistry from different parts of the world in addition to the numerous regular clinics and lectures.

Operators after serving four months are eligible, by qualifying, for appointments in the special clinics where postgraduate work is given.

The operators on this staff have the advantage of the clinics and lectures of the Postgraduate School of Orthodontia.

The infirmary clinics provide unusual advantages in the various departments of the institution where operative dentistry, orthodontia, nose and throat and oral surgery, extracting, novocaine technic, radiography, pathological diagnosis and research work are continually carried on.

The average number of cases treated daily is more than 450 in all departments.

All material and necessary operating instruments will be furnished; up-to-date apparatus including electric engines, sterile instrument trays, fountain cuspidors, compressed air, and the modern operating-room-type of lavatories are available for use.

A diploma for service will be issued by the trustees to each member of this staff who has completed this term of service in a satisfactory manner.

Applications for the above positions should be made not later than May 18.

Information and the date of the examination will be furnished to those interested by Harold DeW. Cross, D.M.D., Director, 140 The Fenway, Boston, Mass.

The Public Press in Dentistry

WITH the realization of the importance of focal infections by the medical profession, the need of educating the public in regard to the care of the teeth has become a question of vital importance. Suggestions for the promulgation of this knowledge have been made by a great number of men during the last few years. None of the plans so far suggested are entirely satisfactory, but all are capable of accomplishing some good purpose. The public press has been advocated as a medium.

We realize that there is no other means of education that has as much influence as the public newspaper; however, it must be remembered that anything having such a widespread influence as the public press must be carefully handled, or it will become a detriment as well as a benefit.

As an example of the injury that publication can do a subject, we need only look at the widespread publicity that is given emetine in the treatment of pyorrhea. Articles by medical men and by lay writers appeared in various newspapers and magazines heralding emetine as a cure for pyorrhea. People obtained their knowledge of the treatment of pyorrhea from the public

press, and as a result of this, dentists had patients coming to them with clippings from newspapers, demanding that treatment be given them in their case. As another example of unwise publicity we call attention to that given "606" some years ago. These cases are cited simply to show that information through the public press, unless entirely reliable, may not be information that is desirable. In the majority of instances articles that have been published in the press dealing with the care of the teeth have produced more good than harm; nevertheless, if articles were more carefully edited and were written by some one better versed in dentistry, they would accomplish much more than they do.

Only recently in a paper which contains a health column conducted by a very prominent medical man there appeared an article entitled "The Care of the Teeth," in which was cited a paper dealing with dentistry as an economic factor in a large manufacturing plant. On the whole the article was very good, and was one which undoubtedly attracted considerable attention and comment. However, there was one grave mistake made. The statement was made that "the permanent teeth do not begin coming through the gums until the child is seven years of age." If this statement is taken literally, as it will be by a great many people, it eliminates entirely the time of eruption of the first permanent molars which make their appearance before the age of seven, and which often require dental attention before that period. A great many mothers take the first permanent molar for a deciduous tooth because it erupts without the loss of any of the deciduous teeth, and this idea is permitted to exist by the statement of the medical man that the permanent teeth do not erupt before the age of seven. We can imagine a great many mothers making the statement that they thought the permanent molar was a deciduous tooth because they had read in the newspaper that permanent teeth did not erupt before the age of seven. We will admit that this particular statement does not entirely ruin the article, but we believe that, had it been more carefully edited, it would have accomplished more good, and would not have been the possible source of misunderstanding that it is, appearing in the present condition.

We recognize the importance of the public press as a means of giving knowledge on dental subjects; but articles would accomplish more if edited by a dental hygiene committee or someone entirely familiar with the subject than if written by a layman or by a medical man who has gleaned his knowledge of dentistry by hearsay and reading.

The Duty of the Employer in the Reconstruction of the Crippled Soldier

WE must count on the return from the front of thousands of crippled soldiers. We must plan to give them on their return the best possible chance for the future.

Dependence cannot be placed on monetary compensation in the form of a pension, for in the past the pension system has proved a distinct failure in so far as constructive ends are involved. The pension has never been enough

to support in decency the average disabled soldier, but it has been just large enough to act as an incentive to idleness and semi-dependence on relatives or friends.

The only compensation of real value for physical disability is rehabilitation for self-support. Make a man again capable of earning his own living and the chief burden of his handicap drops away. Occupation is, further, the only means for making him happy and contented.

Soon after the outbreak of hostilities the European countries began the establishment of vocational training schools for the rehabilitation of disabled soldiers. They had both the humanitarian aim of restoring crippled men to the greatest possible degree and the economic aim of sparing the community the burden of unproductivity on the part of thousands of its best citizens. The movement had its inception with Mayor Edouard Herriot of the city of Lyons, France, who found it difficult to reconcile the desperate need for labor in the factories and munition works while men who had lost an arm or a leg but were otherwise strong and well were idling their time in the public squares. He therefore induced the municipal council to open an industrial school for war cripples which has proved the example and inspiration for hundreds of similar schools since founded throughout France, Italy, Germany, Great Britain and Canada.

The disability of some crippled soldiers is no bar to returning to their former trade, but the injuries of many disqualify them from pursuing again their past occupation. The schools of training prepare these men for some work in which their physical handicap will not materially interfere with their production.

The education of the adult is made up largely of his working experience. The groundwork of training in his past occupation must under no circumstances be abandoned. The new trade must be related to the former one or be, perhaps, an extension or specialization of it. For example, a man who had done manual work in the building trades may by instruction in architectural drafting and the interpretation of plans be fitted for a foreman's job, in which the lack of an arm would not prove of serious handicap. A trainman who had lost a leg might wisely be prepared as a telegrapher, so that he could go back to railroad work, with the practice of which he is already familiar.

Whatever training is given must be thorough, for an adult can not be sent out to employment on the same basis as a boy apprentice. He must be adequately prepared for the work he is to undertake.

The one-armed soldier is equipped with working appliances which have supplanted the old familiar artificial limb. The new appliances are designed with a practical aim only in view; they vary according to the trade in which the individual is to engage. For example, the appliance for a machinist would be quite different from that with which a wood turner would be provided. Some appliances have attached to the stump a chuck in which various tools or hooks can interchangeably be held. The wearer uses these devices only while at work; for evenings and holidays he is provided with a "dress arm" which is made in imitation of the lost natural member.

An important factor in the success of re-educational work is an early start, so that the disabled man shall have no chance to go out unemployed into the community. In even a short period of exposure to the sentimental sympathy of family and friends, his "will to work" is so broken down that it becomes difficult again to restore him to a stand of independence and ambition. For this reason, therefore, the plan for his future is made at as early a date as his physical condition admits, and training is actually under way before the patient is out of the hospital.

In the readjustment of the crippled soldier to civilian life, his placement in employment is a matter of the greatest moment. In this field the employer has a very definite responsibility.

But the employer's duty is not entirely obvious. It is, on the contrary, almost diametrically opposite to what one might superficially infer it to be. The duty is not to "take care of" from patriotic motives, a given number of disabled men, finding for them any odd jobs which are available, and putting the ex-soldiers in them without much regard to whether they can earn the wages paid or not.

Yet this method is all too common. A local committee of employers will deliberate about as follows: "Here are a dozen crippled soldiers for whom we must find jobs. Jones, you have a large factory; you should be able to take care of six of them. Brown, can you not find places for four of them in your warehouse? And Smith, you ought to place at least a couple in your store."

Such a procedure can not have other than pernicious results. In the first years of war the spirit of patriotism runs high, but experience has shown that men placed on this basis alone find themselves out of a job after the war has been over several years, or in fact, after it has been in progress for a considerable period of time.

A second weakness in this method is that a man who is patronized by giving him a charity job, comes to expect as a right such semi-gratuitous support. Such a situation breaks down rather than builds up character, and makes the man progressively a weaker rather than a stronger member of the community. We must not do our returned men such injury.

The third difficulty is that such a system does not take into account the man's future. Casual placement means employment either in a makeshift job as watchman or elevator operator such as we should certainly not offer our disabled men except as a last resort—or in a job beyond the man, one in which, on the cold-blooded considerations of product and wages, he can not hold his own. Jobs of the first type have for the worker a future of monotony and discouragement. Jobs of the second type are frequently disastrous, for in them a man, instead of becoming steadily more competent and building up confidence in himself, stands still as regards improvement and loses confidence every day. When he is dropped or goes to some other employment, the job will have had for him no permanent benefit.

Twelve men sent to twelve jobs may all be seriously misplaced, while the same twelve placed with thought and wisdom and differently assigned to the same twelve jobs may be ideally located. If normal workers require expert

and careful placement, crippled candidates for employment require it even more.

The positive aspect of the employer's duty is to find for the disabled man a constructive job which he can hold on the basis of competency alone. In such a job he can be self-respecting, be happy, and look forward to a future. This is the definite patriotic duty. It is not so easy of execution as telling a superintendent to take care of four men, but there is infinitely more satisfaction to the employer in the results, and infinitely greater advantage to the employee. And it is entirely practical, even in dealing with seriously disabled men.

A cripple is only debarred by his disability from performing certain operations. In the operations which he can perform, the disabled man will be just as efficient as his non-handicapped colleague, or more so. In the multiplicity of modern industrial processes it is entirely possible to find jobs not requiring the operations from which any given type of cripples are debarred. For such jobs as they can fill the cripple should be given preference.

Thousands of cripples are now holding important jobs in the industrial world. But they are men of exceptional character and initiative and have, in general, made their way in spite of employers rather than because of them. Too many employers are ready to give the cripple alms, but not willing to expend the thought necessary to place him in a suitable job. This attitude has helped to make many cripples dependent. With our new responsibilities to the men disabled in fighting for us, the point of view must certainly be changed. What some cripples have done, other cripples can do—if only given an even chance.

The industrial cripple should be considered as well as the military cripple, for in these days of national demand for the greatest possible output there should not be left idle any men who can be made into productive workers.

With thoughtful placement effort, many men can be employed directly on the basis of their past experience. With the disabled soldiers who profit by the training facilities the government will provide, the task should be even easier.

This, then, constitutes the charge of patriotic duty upon the employer:

To study the jobs under his jurisdiction to determine what ones might be satisfactorily held by cripples. To give the cripples preference for these jobs. To consider thoughtfully the applications of disabled men for employment, bearing in mind the importance of utilizing to as great an extent as possible labor which would otherwise be unproductive. To do the returned soldier the honor of offering him real employment, rather than proffering him the ignominy of a charity job.

If the employer will do this, it will be a great factor in making the complete elimination of the dependent cripple a real and inspiring possibility.

DOUGLAS C. MCMURTRIE, DIRECTOR,
Red Cross Institute for Crippled and Disabled Men.
New York City.